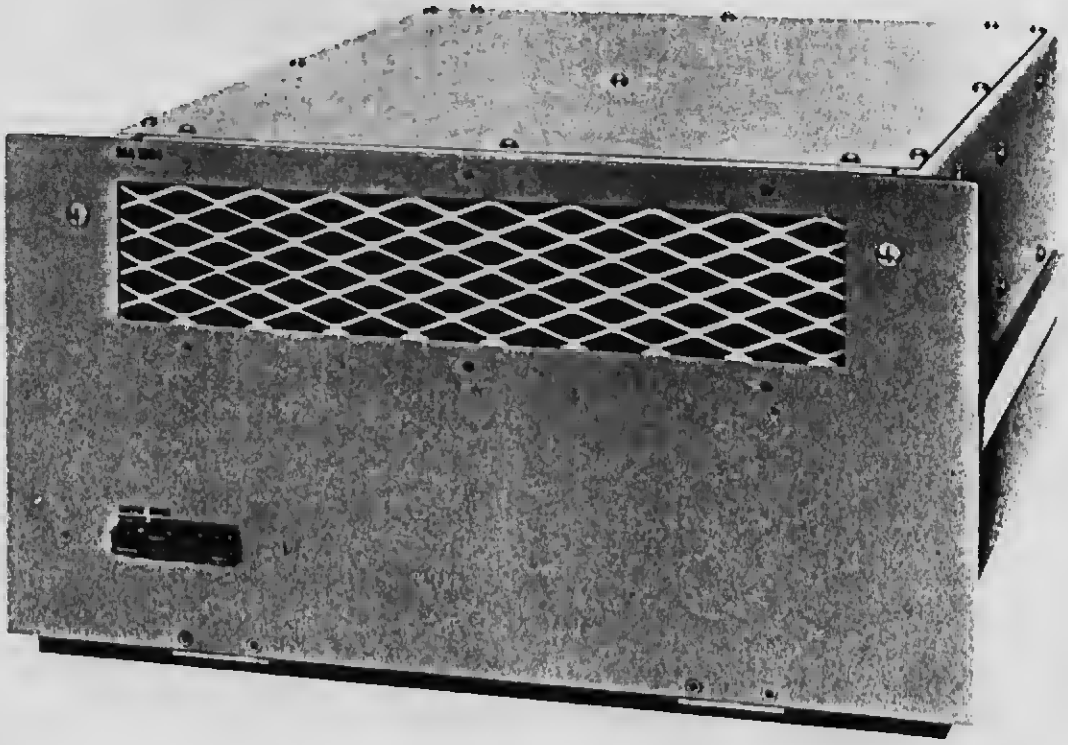
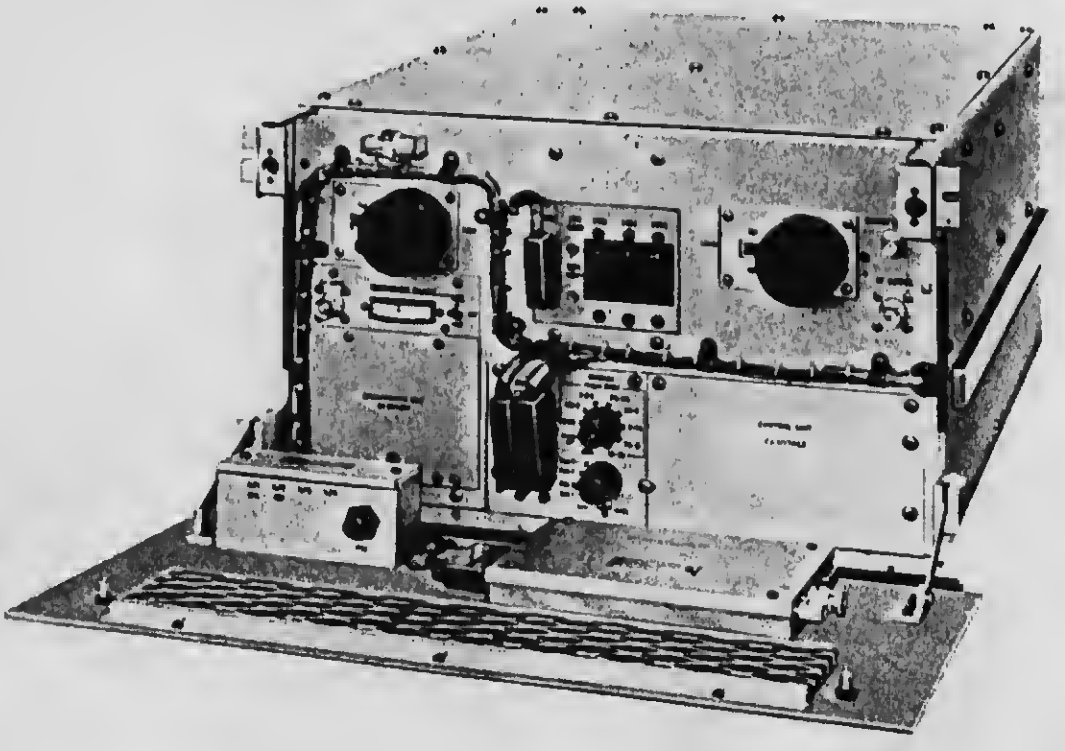




VIEW WITH FRONT PANEL LOWERED

FEEDER MATCHING UNIT MA.1004

CONTENTS

TABLES

ILLUSTRATIONS

TECHNICAL SPECIFICATION

Frequency Ronge	1.6 - 30MHz
Input Power	50W - 1.25kW
Load Impedonce	50 ohm naminal - moximum VSWR 3:1
Input Impedance	50 ohm naminal
Harmonic Output	50mW moximum (when used with Rocol ronge of salid state transmitters).
Tuning Time	8 Seconds Moximum 3 Seconds Typicol
Low level input	25 - 200mW
Low level input impedance	50 ohm nominol
Power Consumption	350 VA maximum
Moins Input (Voltoge Ronge	210V - 250V
(	+6% -10%
(Frequency Ronge	47 - 60Hz
Type of Tuning	Automotic with manuol override
Weight	30kg (66lb)
Dimension	266mm (10.5/8in.) x 600mm (24in.) x 482mm (19¼in.)
Temperoture Ronge (Storage	-40°C to +70°C
(Operoting	-10°C to +55°C
Relotive Humidity (Operating)	95% ot 40°C

CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1. The MA.1004 Feeder Matching Unit (FMU) matches the 50ohm output of the Racal 1KW and 500W wideband solid-state linear amplifiers to antennas having impedances of up to 3:1 VSWR relative to 50ohm.

2. A power output of 1kw CW can be accepted, in the range 1.6 to 30MHz. Tuning of the FMU is carried out automatically; the maximum time required for a frequency change is eight seconds, average time is three to four seconds. Manual tuning facilities are provided for emergency or maintenance purposes.

3. The matching network consists of two variable inductors and a switched bank of ceramic capacitors arranged in 'T' configuration. The matching network also forms a low-pass filter which attenuates harmonics of the wanted frequency.

4. The FMU is a self-contained unit complete with power supply. It is, however, normally operated only within the associated transmitter cabinet.

5. The FMU is servo-tuned in two sequences, an initial coarse-tune sequence followed by a fine-tune sequence. A low level (25mW into 50ohm) drive is required for coarse-tuning, followed by a high power (50W minimum) input. The low-level drive is the normal output from the drive unit to the linear amplifier, the high-power signal is the output from the Linear Amplifier to the antenna.

PHYSICAL DESCRIPTION

Figs 29 & 30

6. The FMU is normally mounted on angle supports within the main transmitter cabinet. The unit can be withdrawn from the front of the cabinet but cannot be operated in the withdrawn position. The dimensions and weight are given in the Technical Specification.

7. The unit is constructed of sheet metal and embodies a main chassis upon which is mounted the sub-assemblies. A prefix coding system is used to provide unique identification of units, boards and components as listed below.

Sub-Assembly	Prefix Ref.
Main assembly (chassis)	1
Power Supply MS448	2
Including Power Supply PC Board PS57	2A

Sub-Assembly	Prefix Ref
Central Unit (MS450)	3
Including	
Motherboard PW178	3A
Range PC Board PS60	3B
Tune PC Board PS59	3C
Tune Servo Pre-amplifier PC Board PS108	PS108 (Tune)
Load Servo Pre-amplifier PC Board PS108	PS108 (Load)
Fine-Tune Discriminator (MS449)	4
Including	
Discriminator PC Board PS56	4A
Constant Voltage Amplifier (CVA) (MS454)	5
Including	
CVA PC Board PS58	5A
Coil, Motor and Gearbox Assembly (MS451) (Two)	6 (Coils are identified as IL1 and IL2)
Including	
Coarse-Tune Discriminator (PS106) (Two)	6A
Microswitch Bank Assembly	7
Tune Servo Power Amplifier (including PC Board PS201) (MS265)	9
Load Servo Power Amplifier (including PC Board PS201) (MS265)	9

BRIEF TECHNICAL DESCRIPTION

8. The RF network is a 'T' section filter comprising two continuously variable inductors and a bank of fixed ceramic capacitors, combinations of which are selected in eight ranges appropriate to the operating frequency. The wipers of the variable inductors are each positioned by an integral motor and gearbox which is driven by associated power and pre-amplifiers forming two independent Servo systems. The appropriate ceramic capacitors are connected by spring contacts, each operated by a solenoid and selected by the control unit. A section of each variable inductor is shorted out on the two highest frequency ranges by a similar mechanism.

AUTOMATIC TUNING

9. The sequence of Automatic Tuning is as follows:-

(a) Coarse Tuning

The low level RF drive to the Linear Amplifier from the Drive Unit is removed and rerouted, via a constant voltage amplifier (CVA), to the two coarse-tune discriminators. The outputs of the coarse tune discriminators are switched to the two servo amplifiers. The capacitor bank is then reset to neutral (i.e. no capacitors selected). The servo motors drive the wipers of the coils to the

correct position to obtain zero output from the discriminators, i.e. the coorse-tuned condition.

(b) Coarse Tune/Fine Tune Change over

When the servo motors hove completed coarse tuning ond a detector hos sensed that the servo amplifier outputs have fallen to o sufficiently low level (i.e. servo motors stopped), the control circuit ollows the unit to chonge aver to fine tune. At this time, using information from the motor-driven microswitch bonk, the correct combinotion of ceramic capacitors oppropriote to the coil position (ond hence frequency range) is selected. The RF drive is then removed from the coarse tune discriminotors and reconnected to the lineor amplifier, and the servo omplifier inputs are switched to the fine tune discriminotor output.

(c) Fine Tuning

The fine tune discriminotors somple the amplitude ond phose of the input signal to the 'T' network and provide zero outputs when the nominal 50 ahm resistive condition is obtoined. The phase discriminotor drives the 'tuning' coil wiper ond the omplitude discriminotor drives the 'looding' coil wiper. The servos ore ollowed to fine tune for o short period (obout 1½ seconds) and then o large time constont (integrator) is switched into eoch servo pre-amplifier feedbock loop to prevent hunting. This hos the effect of severely reducing the o.c. loop gain, but mointoining o high d.c. loop goin ond hence high occurocy.

(d) Reody Condition

After o period of about three seconds from the coorse-tune fine-tune change over the control circuits provide o 'reody' signal output. The servos con then be inhibited, via o link in the 'Tune' P.C. Board, or con be left energized, dependent upon the tronsmitter system requirements.

MANUAL TUNING

10. During manuol tuning, the servo system is inhibited and the selection of frequency range is mode ot o rotary switch situoted on the control unit. This unit also contains two other switches associated with manual tuning (i) the line switch, used to select ony one of four coaxiol line lengths between the lineor amplifier RF output and the FMU input (the lines are situoted in the cabinet and in automotic operotion ore selected by external meons) ond (ii) the monuol TUNE/READY switch, which is used to override the 'unready' output signol.

11. Both the manual ronge switch ond the manuol line switch operote vio the range p.c. board to generote the necessory timing sequence so that arcing due to RF connot occur ot the copocitor or inductor contocts as they open ond close. The voriable inductors ore positioned monually using the front ponel control knobs in conjunction with the coorse tuning graph and the fine tune distriminotor output meter.

CHAPTER 2

INSTALLATION AND OPERATION

INTRODUCTION

1. The Installation section of this chopter gives the procedures and connections necessary during initial installation (or re-installation after major maintenance) of the unit. The operating procedures are described in para. 8 and subsequent.

WARNING. DURING OPERATION HIGH-LEVEL RF VOLTAGES ARE PRESENT AT THE RF INPUT AND RF OUTPUT CONNECTORS AND SUPPLY VOLTAGES ARE PRESENT AT CERTAIN MULTI-WAY CONNECTORS; THESE CONNECTORS ARE ACCESSIBLE WHEN THE HINGED FRONT PANEL IS LOWERED. ENSURE THAT POWER IS REMOVED BEFORE ANY CONNECTOR IS DISTURBED.

INSTALLATION

2. The MA.1004 normally forms part of a 1KW or 500W Transmitter Terminal and is mounted in the transmitter cabinet. The following instructions assume that the MA.1004 is to be installed in the tronsmitter cabinet.

Initiol Procedure

3. After unpacking the unit, carry out a careful visual check for any damage that moy hove been incurred during transit or storage. Lower the hinged front panel and remove the top cover of the unit and check that the interior is free of packing material etc. Raise the hinged frant panel.

Supply Voltage Tappings

4. Remove the top caver of the unit and check that valtage tappings are set to suit the local supply voltage (see fig.5). Adjust tappings if necessary, and replace the caver aver the FMU, ensuring that the langer screw is fitted in the central pasition.

Installation into Transmitter Cabinet

5. (1) Ensure that all pawer is removed from the cabinet.

(2) Remove blanking panel (if fitted) from the cabinet, and lower the hinged meter panel.

(3) Arrange the cabinet connecting cables so that they are positioned as clase ta the cabinet sides as passible, with connectors pratruding fram the front of the cabinet.

(4) Lift the FMU (twa people are required) and slide it inta the cabinet, ensuring that cables and connectors are not trapped ar damaged. Da not slide the unit fully into place, but leave it pratruding 60 to 80mm (2 to 3in)

(5) Lower the hinged front panel of the FMU.

(6) Support the cables and slide the FMU fully inta the cabinet.

(7) Secure the FMU with the front panel screws. If necessary release the hinged front panel suppart arms and lower the panel ta its fullest extent to gain access to screws. Replace the support arms in their narmal pasition after securing the FMU.

Cannection of the FMU in Transmitter Cabinet

6. (1) Connect the cabinet cables to the FMU as given in the table belaw, ensuring that the cables do not obstruct the movement af the hinged panel ar the manual tuning controls when the panel is raised.

Cabinet Connector	Connects to	FMU Connector	Remarks
1SK35		1PL1	Mains supply. Arrange the cable to lie along the hinged panel between the hinge ond the constant voltage amplifier (CVA) to its mating connection.
1PL28		5SK1	Low-level RF output
1SK32		5PL1	Law-level RF input
1SK34		5PL2	Control/Interface connections. Push in the cannector, mave the slide lock retainer to allaw connectar to mate fully then move the slide to 'lacked' position.
1PL24		RF Input	High-power RF input
1PL26 (see note)		RF Output	High-power RF output

Nate: The RF autput cable of the cabinet is af extra length to allow the FMU to be by-passed if required (see para. 14). Additional cable should be stowed by pushing carefully into the side skin of the cabinet.

CONNECTOR FUNCTIONS

7. NOTE: If the FMU does not form part of a Racal Transmitter it is important to ensure compatability of equipment.

Plug and Pin No.	Function	Input of Output	Circuit Logic
1PL1	Supply	Input	210 to 250V +6% -10% 47 to 65Hz
Pin (a)	Line		
Pin (b)	Neutral		
Pin (c)	Earth		
5PL1 (50ohm Coaxial)	Low level RF from Exciter	Input	25-200mW 1.6-30MHz
5SK1 (50ohm Coaxial)	Low level RF to Linear Amplifier	Output	As input from exciter (5PL1)
5PL2	Control/Interface connections		
Pin 1	Fault	Output	OV = fault +12V = normal
Pin 2	Tune	Input	OV = Tune open circuit = normal
Pin 3	Ready	Output	OV = Ready +12V = Not ready
Pin 4	Earth from Contactor	Input	OV = Normal Open circuit = otherwise
Pin 5	Earth		
Pin 6) Pin 7)	External Ready Lamp	Output	30V from 120ohm source resistance for 24V, 55mA lamp
Pin 8	Coarse Tune Initiate	Input	Open circuit or +12V = C.T. Initiate OV = Normal
Pin 9	Servos Off	Input	OV = Servos Off Open circuit or +12V = normal
Pin 10	Line 2	Output	OV to energise cabinet line 2 selection relay. Open circuit = relay not energised.

5PL2 (contd) Plug and Pin No.	Function	Input of Output	Circuit Logic
Pin 11	Line 3	Output	OV to energise cabinet line 3 selection relay, Open circuit = relay not energised
Pin 12	+30V switched	Output	+30V supply to line selection relays in 'fine-tune' condition. Open circuit otherwise.
Pin 13	Monual	Output	+30V for 'manual' output to line switching unit (when fitted). Open circuit in 'auto'.
Pin 14	+30V Unstabilized	Output	+30V nom = 30V unstabilized supply available. Open circuit = 30V supply not available.
Pin 15	+30V stabilized	Output	+30V = stabilized supply to line switching unit avoilable (when fitted). Open circuit in other conditions.
4SK1 (50 ohm cooxial)	High-Power RF from linear amplifier	Input	1.25KW maximum 1.6 to 30MHz
1SK1 (50 ohm coaxial)	High-Power RF from FMU	Output	as input from Linear Amplifier Amplifier (4SK1)

OPERATING PROCEDURE

8. When the FMU has been correctly installed as part of a Racal Tronsmitter Terminal it is normally only necessary to carry out the extremely simple Automatic Tuning procedure given in para. 12, after carrying out the Initial Procedure (para. 10). It is however, advisable to carry out the manual tuning Procedure given in para. 11 following initial installation or major mointenance to ensure that the FMU is set-up correctly. The FMU cannot be operated os an independent unit.

CONTROLS AND INDICATORS

Fig.4

9. The following controls and indicotors are fitted to the FMU.

Front Panel

Note: Only the Front panel controls and indicators are used during Automatic Tuning.

(1) SUPPLY ON Push-button switch and indicator lamp

(2) TUNE Push-button switch and indicator lamp. The switch is nat normally used when the FMU forms port of a Rocol Transmitter Terminal. The indicatar lomp illuminotes during a tuning sequence.

(3) READY indicotar lamp. Illuminotes when the FMU is reody to accept traffic.

(4) SERVO LIMIT indicator lamp. Illuminotes when an inductor is driven ta an extreme pasition (see para. 13).

Sub Frant Panel (Accessible when Frant Ponel is lawered)

(5) TUNE cantrol and counter. Allaws monual operation af the TUNE inductor.

(6) LOAD control and counter. Allaws monual operation of the LOAD inductor.

(7) Circuit Breokers CB1, CB2 ond CB3. These protect the FMU pawer supplies.

(8) DISCRIMINATOR BALANCE meter ond three position switch. Used during monuol tuning (paro. 11).

(9) MANUAL switch. The AUTO position is normolly used (poro. 12). The SERVOS OFF position inhibits the servo motors. The remoinder of the positions ore used during monuol tuning (paro. 11).

(10) LINE switch. This switch is used during manual tuning (poro. 11)

(11) TUNE/READY switch. Used ofter manual tuning to signal 'reody' to drive unit.

INITIAL PROCEDURE

10. The following pracedure should be corried aut prior to Automatic or Monual operation.

(1) Ensure that the SUPPLY switch on the frant ponel is OFF.

(2) Check thot the Instollation Procedure (paras. 2 to 7) hos been carrectly corried out.

(3) Lower the front panel and check that the circuit breakers CB1, CB2 and CB3 are ON. Roise frant panel.

(4) Check that the FMU output is cannected to o suitable ontenno or dummy laad.

(5) Mute the output from the drive unit and switch on the system cobinet.

(6) Depress the SUPPLY ON push-buttan and check thot the associoted green indicatar lamp illuminates.

MANUAL TUNING PROCEDURE

11. (1) Carry out the Initial Procedure (para. 10)

(2) Set the TUNE/READY switch to TUNE.

(3) Select the required frequency range at the MANUAL switch. When a frequency is at the end of two bands either band con be selected (e.g. when 2.0000MHz frequency is required either the 1.75 - 2 or the 2 - 2.5 range can be used).

(4) Set the LINE switch to LINE 1.

(5) Switch on the drive unit and set to give an output of between 25mW and 200mW at the selected frequency (see appropriate System Handbook).

(6) Referring to the tuning graph (fig. 1) rotate the manual TUNE control until the appropriate counter setting for the required frequency is indicated.

(7) Refer to graph and set the LOAD control to the appropriate counter setting.

(8) Adjust the monuol TUNE and LOAD controls alternately until the DISCRIMINATOR BALANCE meter needle is centralised, setting the meter switch to TUNE or LOAD os required.

(9) Switch the meter circuit of the linear Amplifier to monitor the FORWARD POWER output (as given in the appropriate handbook) and note the reoding.

(10) Set the switch on the FMU to LINE 2.

(11) Repeat operation (8)

(12) Note the FORWARD POWER output of the linear amplifier

(13) Repeat operations (8) and (9) with LINE 3 selected.

(14) Repeat operations (7) and (9) with LINE 4 selected.

(15) Select the LINE position that gives the greatest power output and finally re-adjust the TUNE and LOAD controls.

(16) Set the TUNE/READY switch to READY and the DISCRIMINATOR BALANCE switch to OFF. The FMU is now correctly tuned.

AUTOMATIC TUNING PROCEDURE

12. (1) Check that the Initial Procedure (para. 10) has been carried out.

(2) When the FMU farms part of a Racal Transmitter System, the tuning initiatian pracedure is normally carried aut autamatically. The TUNE lamp will be illuminated whilst the servas are tuning, fallawed by the illuminatian af the READY lamp after a short delay.

(3) Swi tch on the drive unit and adjust it ta give an autput af between 25mW and 200mW at the selected frequency (see appropriate System Handbook).

(4) If tuning is nat automatically initiated the TUNE push-buttan should be depressed ta initiate a tuning cycle. Alternatively, a TUNE input can be provided at 5PL2-2.

NOTE 1 A tuning sequence will be initiated each time the TUNE button is depressed. Na RF autput is available fram the transmitter when the TUNE button is depressed.

NOTE 2 The selectian af a line suitable far the aperating frequency (operatians 10 to 15 af the manual Tuning Procedure, Para. 11), is carried out automatically during the automatic Tuning Pracedure.

(5) The operatian af the autamatic system can be checked, if required, by ensuring that the caunters adjacent ta the TUNE and LOAD contrals indicate appraximately in accardance with the tuning graph (fig 1) at the end af coarse tuning.

Fault Indication

13. A frant panel SERVO LIMIT indicatar is illuminated if either inductar is driven ta its extreme af travel. If this accurs initiate anather tuning pracedure. If fault is still present check the input frequency and the autput laad impedance. If fault persists refer to Chapter 5.

BY-PASSING OF FMU

14. If a failure of the FMU occurs the assaciated transmitter can cantinue in aperation with a degraded VSWR by by-passing the FMU. The fallawing pracedure shauld be used.

(1) Switch aff the pawer supply ta the cabinet.

(2) Lower the hinged panel of the FMU.

(3) Discannect the high-pawer cables fram the RF INPUT and RF OUTPUT sackets, and jain them tagether, using the adaptar which is narmally clipped ta the FMU sub-frant panel.

(4) Discannect the law level RF cannectars 5PL1 and 5SK1 and connect them together.

(5) Switch on the power supply to the cabinet.

CHAPTER 3

PRINCIPLES OF OPERATION

1. The following paragraphs describe the operation of the FMU during a tuning sequence to suit a change of frequency. Reference should be made to the functional diagram fig.3.

AUTOMATIC TUNING

Initiation of a Tuning Sequence

2. A tuning sequence is initiated by a +12V or open circuit input at 5PL2-8 or, alternatively, by a OV input at 5PL2-2. The front panel TUNE button may also be used in local applications. All three tune signals are commoned and fed to the Tune Board 3C pin 23, then, via 3CTR5 and 3CTR6 to the bistable 3CTR12, 3CTR13, which is reset. This removes the OV Fine Tune signal from 3C pin 16 and de-energises 3CRLA (para.4). At the same time 3CTR14, 3CTR15 and their associated delays are reset, de-energising 3CRLC, removing the Ready output (pin 28) and illuminating the TUNE indication lamp via 3CTR17 and pin 29.

3. The removal of the OV 'Fine-Tune' signal from 3C pin 16 (which is connected to 3B pin 30), results in an open circuit at 3B pin 29 (via 3BTR1 to 3BTR5). The relay 5RLA is, therefore, de-energized (para. 5). The open circuit at 3B pin 29 also removes the +30V output from 3B pin 27 (via 3BTR1, 3BTR6 to 3BTR13), de-energizing the solenoids 1RLA to 1RLF and relay 3RLA.

4. Relay 3RLA switches the servo pre-amplifier inputs to the outputs of the coarse-tune discriminators. Relays 3CRLA and 3CRLC set the gain of the servo pre-amplifiers to the coarse-tune state.

5. Relay 5RLA removes the low-level RF drive from the linear amplifier input and re-routes it, via the constant voltage amplifier (5TR1, 5TR3, 5TR4, 5TR6, 5TR8, 5TR10), to the coarse-tune discriminator inputs.

Coarse Tuning

6. The drive signal (low-level RF input) is fed to the coarse-tune discriminators which provide d.c. outputs. The outputs are amplified by the servo pre- and power amplifiers and cause the motors to drive the coil wipers to new coarse-tune positions.

7. The outputs from the servo pre-amplifiers are also applied (via 3CTR1 to 3CTR4) to gate 3CTR7, and inhibit its output until both pre-amplifier outputs have fallen below a reference level, i.e. until both servos have stopped.

Coarse Tune/Fine Tune Changeover

8. When all three input conditians of gate 3CTR7 (i.e., the two servo pre-amplifier outputs (para.7) and the 'correct RF' condition (para.16)), are satisfied, bistable 3CTR10, 3CTR12, 3CTR13 changes state (i.e. latches) and can only be reset by a coarse-tune initiate signal as described in paragraph 2.

9. The change of state results in

(1) a OV Fine Tune output at 3C pin 16.

(2) RLA being energised, reducing the gain of servo pre-amplifiers.

(3) Delays 3CR27, 3CC10, 3CTR14 and 3CR28, 3CC11, 3CTR15 commence.

10. The OV Fine Tune signal at 3C Pin 16 and 3B Pin 30 causes the output at 3B pin 27 ta rise to 30V via 3BTR6 to 3BTR12 and after a short delay, 3B Pin 29 to be grounded via 3BTR2 to 3BTR5, thus energising 5RLA (paragraph 12).

11. When the output at 3B Pin 27 rises to +30V, a trigger pulse is generated at 3B pin 26 by 3BTR13, and is routed via switch 3SA1 and the micraswitch bank (Unit 7) to the appropriate ronge input on the Range PCB. The pulse is then encoded by diodes and used to select the appropriate combination of copacitors ond coil connections in the main RF network by means of solenoids IRLA to IRLF. At the same time, relay 3RLA is energised, connecting the output of the fine-tune discriminators to the servo pre-omplifiers (porograph 10).

12. When relay 5RLA chonges over, (paragraph 10) the low-level RF drive is removed from the CVA (and coarse-tune discriminators) and re-applied to the linear amplifier input, thus providing o high-power input at 4SK1.

Fine Tuning

13. The outputs of the fine-tune discriminator (Unit 4) cause the servos to drive the coil wipers to the fine-tune position, giving a nominal 50 ohm resistive condition at 4SK1.

14. When delay 3CR27, 3CC10, 3CTR14 elapses, relay 3CRLC is energised, switching a large time constant into the servo pre-amplifiers. This drastically reduces the AC loop gain to prevent hunting, but maintains a high DC gain, giving high accuracy.

Ready Condition

15. When delay 3CR28, 3CC11, 3CTR15 has elapsed, the READY lamp is illuminated via TR16, and the TUNE lamp extinguished, via TR17. At this stage the servos are normally inhibited via the servo pre-amplifier supply gate (3CTR20 to 3CTR23) and link 3LK1. If required, however, the servos may be left energised by the removal of link 3LK1.

'CORRECT RF' DETECTED

16. If the low-level RF input is removed during any stage of the tuning procedure, (or during the 'ready' condition when servos are active), the servos are inhibited after a short delay via the RF detector 5TR15, 5TR16, 5TR17 and 3TR18 to 3TR23. This ensures that the servos cannot 'drift' away from the correctly tuned position in the absence of a compensating output from either the coarse or fine-tune discriminators. If this condition occurs in coarse tune, the coarse tune/fine tune changeover is inhibited via 3CTR7 until the RF is re-applied and coarse tuning is correctly completed. (paragraph 8).

SERVO PROTECTION

17. Current Limit Detector circuits are fitted to prevent the servo motors drawing excessive starting currents. The power amplifier output current is sensed by 9R1 which provides a control voltage via 9D1 to 9D6, to the pre-amplifiers, thus reducing the gain of the system and limiting the output current.

SERVOS OFF

18. At any stage of tuning, or afterwards, the servos may be switched off by two methods. The first is by operation of the manuol range switch to the SERVOS OFF position. The second is by applicotion of an externol servos off (OV) signol to 5PL2-9. In either cose, +30V is applied to 3C Pin 30 which opens the servo pre-amplifier supply gote 3CTR20 to 3CTR23.

FAULT SIGNALLING

19. Both Positive ond Negative stabilised supplies are monitored, ond, in the event of either supply failing, 5TR11-14 produce a fault output (OV) on 5PL2-1 provided that an external earth is applied on 5PL2-4. This earth is routed via the cabinet contactor, so that a fault output is not produced when the cabinet is switched off. If either servo runs to its limit position it operates a microswitch, which is used to disconnect the motor drive, ond to illuminate the front panel SERVO LIMIT indicator. The servo limit condition also produces a fault output on 5PL2-1.

MANUAL TUNING

20. During manual operation the servo systems are completely inhibited and the selection of frequency range and line must be made by the operator (See Chapter 2.).

21. When switch 3SA is set to any of the manual range positions, +30V is applied to 3C Pin 25, via 3SA3 and 3SC1, causing 3CTR8 to 'pull down' the input to TR5, thus providing a 'tune' signal. The Fine Tune output on 3C Pin 16 is therefore removed but, after delay 3CR22, 3CC8 has expired is reapplied through 3CTR8, 3CTR9. The trigger pulse from 3B Pin 26 (para.11) is now routed through 3SA1 to the appropriate range input on the range P.C.B. and through 3SA2, 3SC2 to the appropriate line input(a) on the range p.c.b.

22. The range P.C.B. operates normally to select appropriate capacitor cambinations and coil connections; in addition it selects line lengths, at the transmitter, as the normal selectian method is averridden by the manual signal.

23. If either 3SA or 3SC is maved ta another positian, the +30V signal on 3C Pin 25 is briefly interrupted as the switch passes between pasitians, therefore the OV fine tune autput fram 3C Pin 16 is mamentarily last. This causes the salenoids IRLA to IRLF to be unlatched. When the +30V reappears a trigger pulse is generated ta reselect the combinatian appropriate to the new switch pasition. There is no necessity ta remove the drive because the narmal protective time sequencing operates during manual canditions.

24. Selection of a manual range applies a tune signal ta 3C Pin 23, therefore the 'Ready' output must be pravided manually. This is achieved by operatian af switch 3SB which grounds 3CTR15 output via 3CTR8 (in 'manual' anly), removes the TUNE output, and provides a READY autput.

CHAPTER 4

DETAILED CIRCUIT DESCRIPTION

INTRODUCTION

1. The overall function of the unit is given in chapter 3. This chapter gives a detailed description of the circuits, the majority of which are maunted on printed circuit baards.

2. Each baard carries a prefix cade, as given in chapter 1, para. 7. The prefix cades are, generally, omitted fram component references in this chapter unless the amissian can cause ambiguity.

OVERALL CIRCUIT (prefix cade 1) Fig.31

3. The averall circuit cannectians are mainly self-evident, or hove been discussed in chapter 3. Capacitors IC6 and IC7 form a potential divider which provides a sample af the RF autput at 1SK2 (via IR1) for monitoring purposes.

POWER SUPPLY MS 448 (Prefix Codes 2 and 2A) Fig.7

4. Components af the PC Baard PS57 within the pawer supply are prefix coded 2A, other campanents are coded 2. All input and output cannections to the unit are made via a fifteen-way connectar fitted ta the frant of the unit.

5. The unit provides the fallowing outputs.

+30V (nominal) unstabilized DC 1.5A

-30V (nominal) unstabilized DC 1.5A

+30V stabilized DC 1.5A

-30V stabilized DC 0.2A

6. The circuit utilises a single-phase transfarmer with two secandary windings each feeding a bridge rectifier and reservoir capacitor. The supply input is vio a circuit breaker CB1. The rectified outputs are protected by damped circuit breakers in each supply rail. If a circuit breaker trips both the stabilized and unstabilized autputs af the appropriate palarity are interrupted (See Nate following para. 10). The stabilized outputs are also individually protected by electronic trip circuits (para. 8).

7. The pasitive stabilizer circuit aperates as fallows. Zener diode 2AD3 and resistor 2AR20 provide a stable reference voltage which is applied ta the emitter of 2ATR6. A sample af the autput valtage is fed via the potential divider chain 2AR22, 2AR23 and 2AR24 ta the base of 2ATR6 which it is compared with the reference valtage. If the output voltage tends to be high the conductian of 2ATR6 is increased, reducing the

voltage at 2ATR5 base. Transistors 2ATR5 and 2TR1 are emitter-followers which provide current gain, therefore the reduced voltage at 2ATR5 pravides a reduced output valtage. The autput level, which may be set by adjusting 2AR23, is therefare maintained at a sensibly canstant level.

8. The pasitive current trip circuit operates as follaws. The autput current is fed via 2AR10 and a proportian of the voltage developed across 2AR 10 (determined by the patential divider 2AR8, 2AR12) is applied acrass the base and emitter af 2ATR1. When this voltage reaches the trip level, 2ATR1 canducts, driving 2ATR3 into conduction. A rapid change of state then occurs because, as 2ATR3 conducts 2ATR1 is alsa driven mare fully, causing both transistars to 'latch' in the fully conducting candition.

9. The voltage at the callectar of 2ATR3 drops to about 0.5V causing the voltage at 2ATR6 collector ta drop ta about +1.2V (via D1). The output valtage is, therefare, effectively reduced to zero and can only be reset by switching aff the mains supply, allawing time for capacitor 2C1 to discharge (about 10 secands), then switching an again.

10. The negative stabilizer and trip circuit operates in a similar monner ta that described for the pasitive circuit.

NOTE: On some units the +30V stabilized supply is not routed via circuit breaker 2CB2.

CONTROL UNIT MS450 (Prefix code 3) Fig. 10

11. The control unit is an aluminium box containing the lagic circuits, capacitor switching and timing circuits and servo pre amplifiers. These functions are performed by four plug-in P.C. boards, which mate with a mother board inside the unit. Also contained in the unit are switches far manual contral, a power transistor to provide a switched supply to the cabinet line-switching relays during fine-tuning and a reloy used to switch the servo pre-amplifier inputs to either the coarse-tune or fine-tune discriminators. The cantrol unit prefix cade is 3, the individual printed circuit boards within the unit carry the following cades.

Code 3A	Motherbaard PW178
Cade 3B	Ranged Printed Circuit Board PS60
Code 3C	Tune Printed Circuit Board PS59
Code PS108 (Tune)	Tune Pre-Amplifier PS108
Code PS108 (Load)	Load pre-Amplifier PS108

12. The motherboard provides intercannections between the boards plugged into it, and includes RF filtering camponents for the Servo Pre-Amplifier inputs. The main functian of the Range PC Board is ta select the appropriate capacitars from the capacitar bank to suit the selected frequency. The Tune PC Board performs most of the logic and timing functions associated with the tuning sequence. The twa Servo Pre-Amplifiers provide the high DC voltage gains necessary to raise the outputs from the discriminators ta a level

sufficient to drive the serva power amplifiers and motors. Transistor TR1 provides a supply for relay 3RLA and the line switching relays in the Cabinet, and is controlled fram pin 27 of the Range PCB (para. 23).

RANGE PC BOARD PS60 (Prefix Code 3B) Fig. 12

13. The Range PC Baard encodes the range (frequency band) information from the micraswitch bank or manual range switch and switches into the high-power circuit the correct combination af capacitars. It alsa switches the inductor solenoids and provides the necessary delays ta prevent the capacitor and inductor solenoid contacts making and breaking whilst RF drive is applied ta the linear amplifier. During manual aperation the circuits also switch the coaxial relays in the Transmitter cabinet to provide one of four coaxial line lengths between the linear amplifier output and the FMU input. The operatian of these relays is also sequenced ta prevent orcing at the contacts.

14. A stabilized +30V supply is applied to pin 31 of the Board, the earth connection is at pin 32.

Delay Circuits

15. At the completion of coarse tuning the input at pin 30 (normally at +30V) changes to approximately +2V, cutting-off TR1. After a delay, caused by C2 discharging to approdimately 6V, TR6 is cut-off, causing TR7 and TR8 to conduct and C4 to be rapidly charged via R13. The Darlington pair TR9 and TR11 are then driven into conduction, causing TR10 and TR12 to conduct and provide a +30V supply to the solenoids (via pin 27).

16. At the same time as TR6 turns off, TR2 and TR3 are also cut-off, allowing C3 to charge via R9 and R10. When the voltage across C3 rises to approximately 24V transistor TR4 is cut off and TR5 is driven into conduction, providing an output ta relay 5RLA (CVA) which remaves the low level RF drive fram the coarse-tune discriminator and routes it to the linear amplifier.

17. When changing from fine to caarse tune, pin 30 is open circuited and TR1 conducts, rapidly charging C2 thraugh R4. TR2 and TR3 canduct, rapidly discharging C3, via R8; TR4 conducts and TR5 is cut-off. The relay 5RLA is thus de-energised and the RF input removed from the linear amplifier. At the same time as TR2 to TR5 conduct, TR6 also canducts, cutting-off TR7 and TR8 and causing C4 ta discharge through R14, R15 until, at approximately 6V, TR9, TR11, TR10, TR12 cut-off, de-energising the solenoids.

18. In manual operatian, the input to pin 30 is only briefly interrupted between manual ranges, therefore, TR1 acts as a pulse stretcher to ensure that the delays have sufficient time to operate.

Thyristor Circuits

19. The thyristors CSR1 to CSR7 energize solenoids 1RLA to 1RLF to select the correct capacitor/inductor combination for the frequency range in use (see Table 4.1)

TABLE 4.1

SELECTED CAPACITORS AND SHORTED TURNS

RANGE	RANGE P.C.B.		SOLENOIDS ENERGIZED	CAPACITORS IN CIRCUIT	TOTAL CAPACITANCE	1L1 and 1L2 TURNS
	INPUT PULSE	OUTPUTS (LOW)				
1.6 to 1.75MHz	Pin 25	Pins 1 & 22	IRLA, IRLB	IC1, IC2	900pF + strays	Not shorted
1.75 to 2MHz	Pin 18	Pins 1,2,6	IRLA, IRLD, IRLC	IC1, IC5, IC3, IC4	774pF + stroys	Not shorted
2 to 2.5MHz	Pin 16	Pins 1 & 2	IRLA, IRLD	IC1, IC5	592pF + strays	Not shorted
2.5 to 3.1MHz	Pin 23	Pin 1	IRLA	IC1	510pF + stroys	Not shorted
3.1 to 4MHz	Pin 24	Pin 22	IRLB	IC2	390pF + strays	Not shorted
4 to 7.5MHz	Pin 20	Pins 2 & 6	IRLC	IC3, IC4	182pF + strays	Not shorted
7.5 to 12MHz	Pin 8	Pins 2 & 3	IRLD, IRLE, IRLF	IC5	82pF + strays	Shorted
12 to 30MHz	Pin 5	Pin 3	IRLE, IRLF	NONE	Strays only	Shorted

20. The selected thyristors ore triggered by a single pulse, which is generated ot the some time as the solenoid supply is energized (poro.23), ond ore reset by removing the supply. The +5V triggering pulse is generoted by TR13 ond returned, either vio the microswitch bonk (automotic operotion) or vio the Ronge Switch SA1 (monuol operation), to the oppropriote ronge input of the boord (pin 25, 18, 16, 23, 24, 20, 8 or 5). The pulse is then steered to the oppropriote thyristor(s) vio diodes D8 to D11, D15 to D18 or D20, and opplied to the gotes of the thyristor(s) CSR1 to CSR7.

21. Thyristors CSR1 to CSR5 control solenoids IRLA to IRLF which, in turn, switch copocitors IC1 to IC5 ond the selected turns of IL1 ond IL2. Thyristors CSR6 ond CSR7 ore used, in monuol conditions only, to energize the line selector reloys of the transmitter cobinet.

22. The solenoid IRLA to IRLF, ond reloy 3RLA (which switches the servo pre-amplifier inputs between coarse-tune and fine-tune discriminotors) are energized by a slove tronsistor 3TR1 fed from pin 27.

Trigger Pulse Circuit

23. Tronsistor TR13 generotes o single trigger pulse each time the voltoge ot pin 27 rises from 0 to 30V. When pin 27 is at OV, C5 is dischorged to opproximotely 11V vio D23 ond D6. When TR12 conducts (poro. 16) ond pin 27 rises to +30V, copacitar C5 chorges via D22, R19 ond T13 base-emitter junctian, thus driving TR13 into conductian. The collector voltoge rises to appraximately +30V and this is limited by R20, D7 to give o +5V pulse at pin 26. When C5 is olmast fully charged the voltage ocross R18 folls to below 0.6V, cutting-off TR13 and cousing the completian of the output pulse ot pin 26.

TUNE P.C. BOARD PS59 (Prefix Code 3C) Fig.14

24. The Tune PC Boord PS59 contoins circuits which

(1) Control the Coarse-Tune, Fine-Tune, Ready Sequence.

(2) Detect when the servo motors ore running.

(3) Switch the goin of the servo pre-amplifiers during tuning.

(4) Signol the stote of the FMU.

25. The operotion of the circuit is described, ossuming a stort from the 'in-coorse-tune' state ond progressing through 'fine tune' to 'Reody', ond reverting to the 'in-coorse-tune' stote due to o 'tune' signal.

Servo Condition Detector

26. The outputs of the two servo pre-omplifiers (poro.45) ore fed vio pins 13 ond 7 of the Tune PC Boord, to transistors TR1 ond TR2, which ore non-inverting for positive inputs ond inverting for negotive inputs. The transistors provide opproximotely unity goin.

The outputs at TR1 and TR2 collectors are, therefore, equal to the magnitude of the corresponding pre-amplifier outputs, and are combined in the 'or' gate D1, D2. The greater of the two outputs is compared, by the long-tailed pair TR3, TR4, with a reference voltage of approximately 12V, developed by R10 and R11.

27. When either output is greater than approximately +12V (which is less than the pre-amplifier output required to drive a motor against 'stiction') the servo running' condition is detected, and the collector of TR4 rises to approximately 27V. During 'servo stopped' conditions TR4 collector is at approximately 18V.

AND Gate D3, D6

28. The output of TR4 (servo(s) running) and the RF detector (see para.65) are combined in diodes D3, D6 which form an AND gate. The gate therefore gives a 0 volt output when

(1) The servo motors are NOT running

AND (2) RF drive is present at the detector.

29. Resistor R14 and Capacitor C5 give a delay on the output of the gate so that, should RF drive be removed during coarse tuning, and then re-applied, the servo pre-amp. outputs will have time to recover and prevent TR7 from being spuriously turned on. (See next para.).

Gate TR6, TR7

30. The output of AND gate D3, D6 is applied to TR7 and the output of pulse stretcher TR5 (Para.39) is applied to TR6. TR6 and TR7 form gates which give approximately +20V on TR7 collector when

(1) Both servos are stopped.

AND (2) RF drive is present at the detector

AND (3) There is no (TUNE) output from TR5.

These are the three conditions for coarse tune/fine-tune changeover.

Bistable TR10, TR12 and TR13

31. When these three conditions are satisfied the outputs of gates TR6 and TR7 cause the bistable TR10, TR12 and TR13 to changeover and latch. This is achieved by the 20V at TR7 collector which drives TR10 and TR12 into conduction and cuts-off TR13.

Relay and Time Delay Circuits

32. The conduction of TR10 and TR12 reduces the output at pin 16 to +2V (normally at approximately +6.5V) via D13, and energizes relay RLA via D16. Relay RLA contacts switch the gain of the pre-amplifiers (para.45). The cutting-off of TR13 causes the two delay circuits R27, C10 and R28, C11 to commence timing.

33. After approximately 1.5 seconds, i.e. when C10 has charged to approximately 9V, TR14 turns on and operates RLC, provided that the +30V servo supply is available (para.35). The contacts of relay RLC are also used to switch the gain of the servo pre-amplifiers (para.45).

34. After a further delay of approximately 1.5 seconds capacitor C11 has charged to about 9V, driving TR15 and TR16 into conduction and producing a 'ready' (+30V) signal at Pin 28. TR17 is therefore cut off, removing the tune signal from pin 29.

Servo Supply Switching Circuit

35. The servos are switched off by removing the ±30V supplies to the servo pre-amplifiers. This can be achieved by four methods.

(1) An external 'Servos Off' signal, routed via the CVA (unit 5)

(2) An internal 'Servos Off' signal from switch 3SA (Manual range switch).

(3) Link LK1 on the Tune PC Board is normally connected to switch off the servos when the 'ready' state is achieved.

(4) Absence of the 'correct RF' signal (OV) at pin 20.

36. The first three signals are connected together and operate instantaneously. When any of these are present, approximately +30V is applied at Pin 30 and this cuts off TR20, thus overriding TR19. TR20 to TR23 are therefore cut off removing the ±30V supplies to the servo pre-amplifiers. The last signal operates via a delay so that, during keying, the servos will not be switched at the keying rate. During longer periods of no-drive, however, the servos are inhibited to prevent long term d.c. drift from driving the servos in the absence of a compensating discriminator output.

37. The incorrect RF signal (+30V) at pin 20 cuts off TR18 and, when C14 has discharged via R37, R38 to about 36V, TR19 is cut off. This cuts off TR20 to 23 as given previously and removes the servo supplies.

Coarse Tune Initiate Circuit

38. A tuning sequence is initiated by a OV input to Pin 23 which performs the following functions

(1) It resets the two delays R27, C10 and R28, C11 via R29, D21 and D24, thus de-energising RLC and removing the READY signal (See para.34).

(2) It resets the bistable TR10, TR12, TR13, via TR5 and TR6 by removing the supply to TR13 collector and removing the input to TR10 base.

39. TR5 is a pulse stretcher which turns off for about 200ms when a short (minimum 2m sec) OV Tune input is applied at Pin 23. This ensures that the bistable has sufficient time to reset.

40. The reset bistoble allows Pin 16 to rise to about +6.5V (limited on the ronge PCB) ond de-energises relay RLA.

41. The control circuits are now reverted to the coorse-tune stote and the unit is ready to retune to a new frequency.

'Manual' Circuit

42. When monual operotion is selected a +30V input is opplied to pin 25 via switches SA3 ond SC1 (see fig.10). This input drives TR8 into conduction, causing a 'tune' input to TR5. This couses on open circuit output at pin 16 (para.27). Capacitor C8 charges via the coil of reloy RLA, R21 and R22; when the voltage at C8 reoches approximately 2.5V transistor TR9 is driven into conduction ond the open circuit at pin 16 is chonged to a OV output, via D12, TR9, D11, TR8 and D9, thus giving a 'fine-tune' output to the Range P.C. Board.

43. During switch SA3 or SC1 selection the input at pin 25 is momentorily interrupted. Tronsistor TR9 is mointoined in the conducting condition however, os C3 has insufficient time to chorge via R47, preventing TR5 from conducting. After Manual tuning the switch SB must be set ot the READY position to drive TR16 into conduction ond indicote the 'reody' condition (para.38).

THE SERVO SYSTEMS

44. The FMU contoins two identicol servo systems; one drives the input (tune) variable inductor, the other drives the output (lood) varioble inductor. Eoch system consists of

(a) Servo pre-amplifier

(b) Servo Power Amplifier

(c) Servo Gearbox including coorse-tune discriminator.

The inputs to the servo systems are derived from discriminators. The coarse-tune discriminators are part of the Georbox units (Unit 9) and the fine-tune discriminators are unit 4.

SERVO PRE-AMPLIFIERS PS108 (Prefix Code PS108) Fig.15

45. The two Servo Pre-Amplifier Circuits are identicol, both being used to omplify the DC signals from the Discriminotors. The first stage is an operationol omplifier IC1 whose goin is controlled by externol reloys 3ARLA ond 3ARLC mounted on the Tune PCB. The operational amplifier uses supply rails of +12V and -6V which are obtoined by Zener stabilisation from the +30V supplies to the remainder of the PCB. The offset in the input to the operational amplifier is countered by the potentiometer R4 which is odjusted to

give zero output in the balanced state. The output from the operational amplifier is fed to a longtailed pair, TR1 and TR2, and then to a second long-tailed pair TR3 and TR4. These pairs provide voltage amplification whilst minimizing any temperature drift.

46. The output from the second longtailed pair is fed to the output transistors, TR5 and TR6, which provide a relatively low output impedance to the Servo Power Amplifier. The gain of the second stage of the amplifier is controlled by the feedback path from the output of TR5 and TR6 to the output of the operational amplifier through R16. The d.c. balance of the output stage is adjusted by setting R19 to give equal voltages at TP1 and TP2.

47. The gain of the Servo Pre-Amplifier is controlled by external relays. In 'coarse-tune' the feedback is via R10 (1Mohm) and pin 11 is connected to pin 14 to discharge C2 if necessary. This condition gives the maximum loop gain.

48. During fine-tuning pin 11 is externally connected to pin 9, placing R2 in parallel with R10. The gain given in this condition is sufficient to bring the system to almost the correct position but there may be a tendency to hunt about the final position. When the 'ready' condition is obtained, pin 9 is connected to pin 14, switching C2 in parallel with R10 and providing a high d.c. gain and a slow a.c. response to give stability. The amplifier gain is approximately 1500 during coarse-tuning (pins 11 and 14 connected) and approximately 225 during fine-tuning (pins 9 and 11 connected).

49. The motor current feedback (current limit) signal is used to restrict stall current levels in conjunction with the Servo Power Amplifier Board. When the output current from the Servo Power Amplifier Board reaches the current limit, a voltage is fed back to pin 4 on the Servo Pre-Amplifier Board.

50. When this signal is present dominant negative feedback is applied to the long-tailed pairs on the Servo Pre-Amplifier Board via R17. This reduces the voltage gain of the pre-amplifier circuit and limits the current to a safe level during the normal tuning period. If however the high current persists for about 10 seconds, the appropriate circuit breaker in the power supply trips, thereby protecting the servo motor(s).

SERVO POWER AMPLIFIERS MS265 (Prefix Codes 9 and 9A Fig.28

51. Components on the PS201 P.C. Board are Prefix coded 9A, other components are coded 9. The servo power amplifier provides the current gain necessary to drive the servo motor, with a voltage gain slightly less than unity. Transistors TR1 and TR2 form a complex NPN high gain, high current transistor, and TR3, TR4 form a complex PNP high gain, high current transistor. The two complex transistors are arranged as a push-pull complementary pair. The diodes D1 to D6 provide the current limit delay, so that the voltage developed across R1 must exceed $\pm$3V approximately before an output to the servo pre-amplifier is given at pin 7.

COIL, MOTOR AND GEARBOX ASSEMBLY MS451 (Prefix Codes 6 & 6A) Fig.24

52. Components on the Coarse-Tune Discriminator PC Board are prefix-coded 6A, coils are coded 1L1 and 1L2, other components are coded 6.

Motor and limit Switches (Prefix Code 6)

53. The motor M1 is used to drive a variable inductor (1L1 'tune' or 1L2 'load') through reduction gears. Limit switches SA1 and SB1 are used to electrically disconnect the motor before mechanical end stops are reached. When the motor is driving towards the LF position a positive voltage is applied at the input pin 8. If the microswitch SB1 is operated the return path through the motor is opened and diode D2 places a short circuit across the motor to give rapid braking. When the motor is required to retune the inductor to a higher frequency, a negative voltage is applied at pin 8, D2 is reverse biassed but D4 conducts, driving the motor away from the end stop. A similar action occurs when the HF limit switch SA1 is operated.

54. Microswitch contacts SA2 and SB2 are used to signal a 'Servo limit' condition.

Coarse-Tune Discriminator (Prefix Code 6A) Fig.25

55. The Coarse-Tune Discriminator PS106 provides a d.c. input to the servo system during coarse-tuning. The RF signal from the CVA is fed via terminal 6TB1-1 to pin 1 of the P.C. board, and to Transformer T1. The signal is then fed to a bridge circuit comprising R1, R2, R3 and the variable capacitor 6C1. The outputs are detected from the junction of R3 and 6C2 and the wiper of R7.

56. 6C2 is ganged to the output of the gearbox and its position is adjusted during 'coarse-tuning' such that its impedance gives equal voltage amplitudes at the two detection points. R7 allows the bridge circuit to be balanced at a frequency of 1.6MHz. The preset variable capacitor 6AC1 allows the bridge, after adjustment at 1.6MHz, to be balanced at 30MHz. The output from pin 3 is fed to the Servo Pre-Amplifier.

FINE-TUNE DISCRIMINATOR MS449 (Prefix Code 4) Fig.19

57. The phase discriminator compares the phase of the input RF voltage and current and provides an output which causes the 'tune' inductor 1L1 to be adjusted to give the resistive condition at the FMU input. The amplitude discriminator compares the amplitude of the input RF voltage and current and provides an output which causes the 'load' inductor to be adjusted to give an input impedance of nominally 50 ohm.

Phase Discriminator

58. The phase discriminator accepts an input from 4L1, a current transformer on the RF input line which produces two equal voltages proportional to, and in phase with, the line current. The voltages are developed across 4AR2 and 4AR5. Components 4R1, 4R2 and 4AC4 form an RC potential divider across the input which develops a voltage across

4AC4 proportional to, and lagging by 90°, the line voltage. This voltage across 4AC4 is vectorially added to the two equal voltages across 4AR2 and 4AR5.

59. If the phase relationship is correct the two resultants are equal in magnitude (see fig.16) and, after rectification in 4AD1, 4AD2, they cancel in 4AR4 to produce zero outputs at pins 5 and 6.

60. If the phase relationship is incorrect the two resultants became unequal in magnitude so that, after rectification, the cancellation is not complete and a d.c. output is produced. This output is fed to the servo pre-amplifier and causes the servo system to reduce the phase error.

61. Variable resistor 4AR4 is used to compensate for any unbalance in the discriminator and 4AR16 to correct the discriminator characteristic at the low frequency end of the range.

Amplitude Discriminator

62. The amplitude discriminator is fed via 4L2, a current transformer on the input line which develops a voltage across 4AR11 proportional to line current. Components 4C1 and 4AC7 provide a capacitive potential divider which develops a voltage across 4AC7 proportional to line voltage. These outputs are rectified in peak to peak detectors, and, if the impedance is correct, the outputs are equal in magnitude and cancel in 4AR10 to produce zero output at pins 2 and 3.

63. Resistor 4AR15 is included to correct the discriminator characteristic at the LF end of the range; resistors 4AR8 and 4AR12 reduce the effect of harmonics on the discriminator output.

64. Meter 4M1 and its associated switch 4SA is used to monitor the discriminator outputs, and is normally only used during manual tuning.

CONSTANT VOLTAGE AMPLIFIER MS454 (Prefix Codes 5 and 5A) Fig.22

65. Components on the PS58 P.C. board of the Constant Voltage Amplifier (CVA) are prefix-coded 5A, other components are coded 5.

66. The CVA contains the input and output circuits which interface the FMU with the transmitter, the low-power RF switching relay, the RF detector and the constant-voltage amplifier. Apart from the high-power RF connections and the supply input, all external connections to the FMU are made via the CVA. The required logic states of external control connections are +12V (nominal) or open circuit for one state and OV for the second state. The connections are listed in Chapter 2.

Ready Circuit

67. The +30V 'Ready' or OV 'Not Ready' signal from the Tune P.C. Board is applied to PL3-14, and is interfaced by TR2 to provide a OV=Ready or +12V = Not Ready

signal at PL2-3. An output is taken via R37 and PL3-10 ta the front panel READY indicator lamp, and, via R40 and PL2-7, ta an external READY indicator lamp. Pin PL3-17 is connected to earth via the serva mator limit switches sa that the earth is removed if a 'serva limit' fault occurs (para.73). PL2-6 is the return for the external READY indicatar lamp.

Coarse Tune Initiate Circuit

68. Coarse tuning is initiated externally by a +12V or apen circuit input at PL2-14 (normal candition of the input is OV). This signal is interfaced by TR5 to provide a OV Initiate signal at PL3-8. An external signal (OV for Initiate) may be applied to pin PL2-2 if required.

Servos Off Circuit

69. The servas can be switched aff by a OV input at PL2-9, which is interfaced by TR9 ta provide a +30V output at PL3-16. The narmal input state is +12V or apen circuit.

Fault Indicatar Circuit

70. Failure of the +30V or -30V stabilized supplies pravides a fault output indication (OV = fault, +12V = normal) at PL2-1. The fault output is alsa provided when a servo limit fault occurs (para.73). An earth input, normally derived from the transmitter cabinet contactor via PL2-4, is required before the fault circuit can operate.

71. When both the +30V and -30V supplies are ovailable TR14 is cut-off due to the reverse bias on D21. In this condition TR13 is conducting and TR12 and TR11 are cut-off, providing a +12V output at pin PL2-1, vio D19 and R32. The output is limited at this voltage by the Zener Diade D17.

72. If the -30V supply fails TR14 is driven into canductian reversing the state af TR13, TR12, and TR11 ond reducing the output ta appraximately +1.5V at PL2-1. If the +30V supply fails, there will be no voltage an D19+ and therefore an PL21, the fault autput, unless this paint is cannected to an external source. In this event D19 is reverse-biassed via R32. TR12 is therefore 'turned on' via R33 and this turns an TR11, reducing the valtage at PL2-1 ta abaut +1.5V.

Serva Limit Circuit

73. A servo limit fault (either 'tune' ar 'laad') applies an earth at PL3-9, which provides an external fault output (OV) at 5PL2-1 (via D16). The SERVO LIMIT indicator lamp is illuminated via R34, PL3-12 and PL3-13.

CVA and Relay RLA

74. When relay RLA/2 is energized by an earth at PL3-21 the low-pawer RF input at PL1 is rauted directly to the output SK1. When the relay is de-energized the input is fed to the CVA via T2, and socket SK1 is earthed.

75. The RF from T2 is applied to the emitters of TR6, TR7, TR8 and TR10 via resistors R18, R19, R26 and R30. The collectors of TR7 and TR8 provide the output of the CVA, which is fed to the coarse-tune discriminators via T1, PL3-4 and PL3-5.

76. The output of T1 is also fed, via C4, ta the detector stage D5, D6 and the detected output is campared, by the long-tailed pair TR1 and TR3, with a reference level set by potentiometer R2. The autput of the comparator, at TR3 collector, is amplified by TR4 and fed to TR6 and TR10, which act as variable shunts acrass TR7 and TR8. The output of the circuit is, therefare, maintained at a canstant level as pre-set by R2.

RF Detector

77. The RF input at PL1 is detected by the peak-ta-peak detector D18, D20, whase output is used to drive TR15 into conduction, which in turn, drives TR16 into conduction. Transistor TR17 is then cut-off, discannecting PL3-15 from the +30V supply and giving an open circuit, 'RF Detected' autput at PL3-15. In the absence of RF TR17 turns on giving +30V at PL3-15.

MICROSWITCH BANK (Prefix Code 7) Fig.27

78. The microswitch bank consist of seven microswitches which areoperated by coms on a shaft driven by the 'tune' motor and gearbox unit. Switch pasitioning at the completion of coarse tuning is, therefore, related to input frequency. The positions of the cams are adjusted so that the microswitches operote in succession at the frequency range changeover points. The microswitch contacts are wired so thot the highest frequency range selected inhibits oll the lower ronge outputs. The output of the switchbonk is fed to the Range PC Board in the Control Unit where it is used to select the combination of capacitors and shorted inductor turns appropriote to the operating frequency.

CHAPTER 5

FAULT LOCATION

INTRODUCTION

1. The only fault indicator fitted ta the FMU is the SERVO LIMIT indicator lamp. The procedure to clear o servo limit fault is given in Chapter 2.

INITIAL FAULT LOCATION

2. The follawing procedure should be corried aut prior ta detailed foult locotion.

(1) Connectors

Check thot oll connectors are securely mated.

(2) Moins Supply

Check thot the circuit breaker 2CB1 is set to ON and thot the supply lomp on the front ponel is illuminoted.

(3) Unstobilized Supplies

Check that circuit breakers 2CB2 and 2CB3 are set ta ON.

(4) Stabilised Supplies

Check that +30V appeors at 2TP1, and thot -30V appeors ot 2TP2 (both test points on the power supply unit.

(5) Check thot the carrect operating pracedure is being used (Chopter 2).

FAULT LOCATION PROCEDURE (MANUAL OPERATION)

3. Fault locotian during manual operation is relatively simple since much af the circuitry is inoperative. The ronge P.C.B. works in the same woy os for automotic operotion, except that in 'manual', it also controls the coaxial line switching relays, whereas in 'automotic' these are controlled by an external unit. Narmal fault finding procedures shauld be applied moking reference to individual circuits.

FAULT LOCATION PROCEDURE (AUTOMATIC OPERATION)

4. The detoiled fault lacation procedure is tabulated under faur headings, viz.

(1) Servo Motars will nat ratote (Table 5.1)

(2) Servos will not Coarse-Tune correctly (Toble 5.2)

(3) Servo Motors will not rotote in 'fine-tune' condition (Toble 5.3)

(4) Servos will not Fine-Tune correctly (Toble 5.4)

The outomotic operating procedure (Chopter 2) should be used during the following procedure.

FAULT LOCATION AT RANGE, TUNE ond PRE-AMPLIFIER BOARDS

5. Extender boards ore ovoiloble to ollow occess to be goined to the Ronge, Tune ond Pre-Amplifier boards in the Control Unit. Extender Board CA 604130 is used with the Tune ond Ronge boards; extender board CA 604163 is used with the Pre-Amplifier boards.

TABLE 5.1

SERVO MOTORS WILL NOT ROTATE

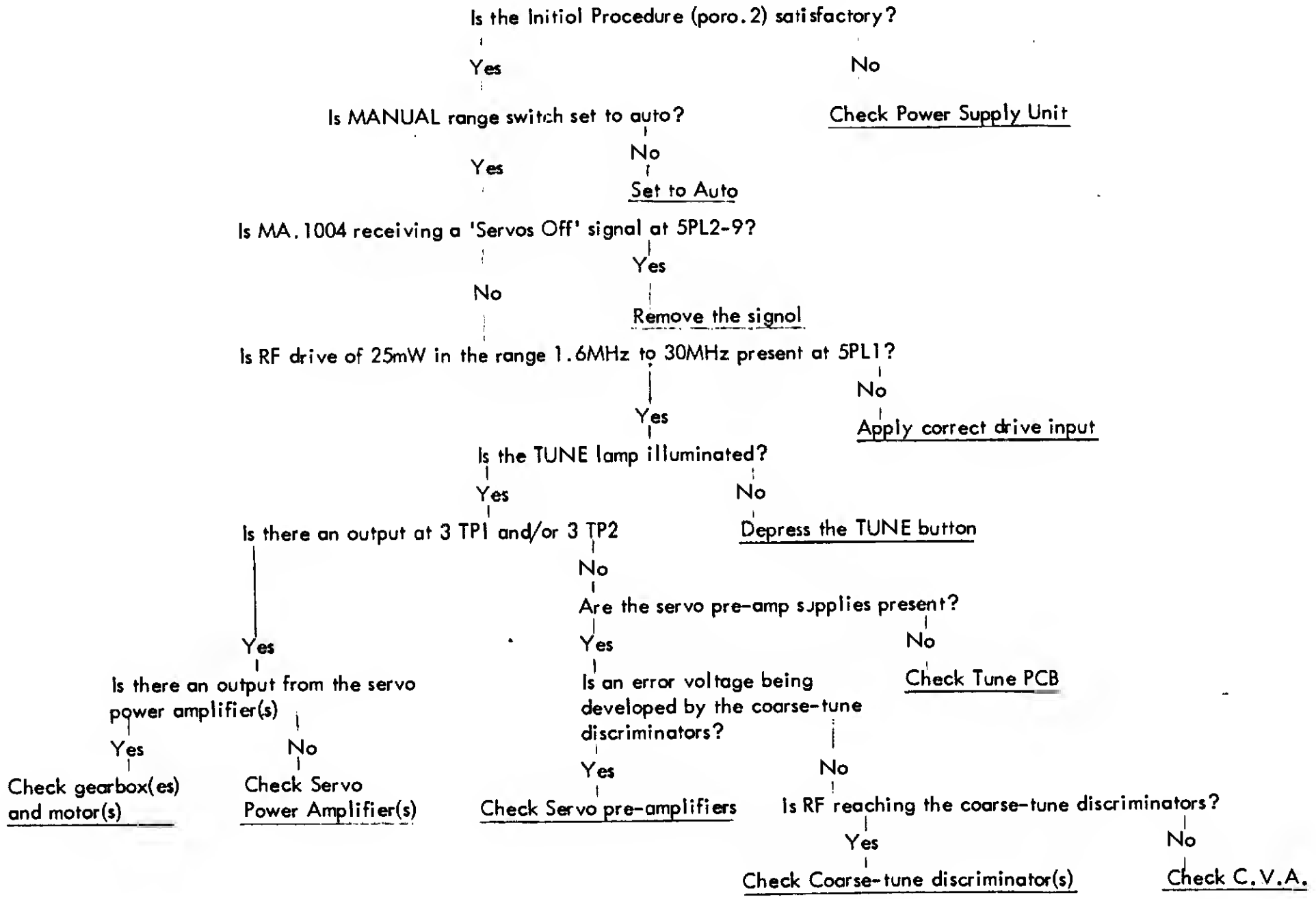


TABLE 5.2

SERVOS WILL NOT COARSE-TUNE CORRECTLY

Check that the low-power drive input is between 1.6MHz to 30MHz (ot 25mW to 200mW). If drive is correct check the coarse-tune trocking (see Chapter 6)

TABLE 5.3

SERVO MOTORS WILL NOT ROTATE IN 'FINE' TUNE CONDITION

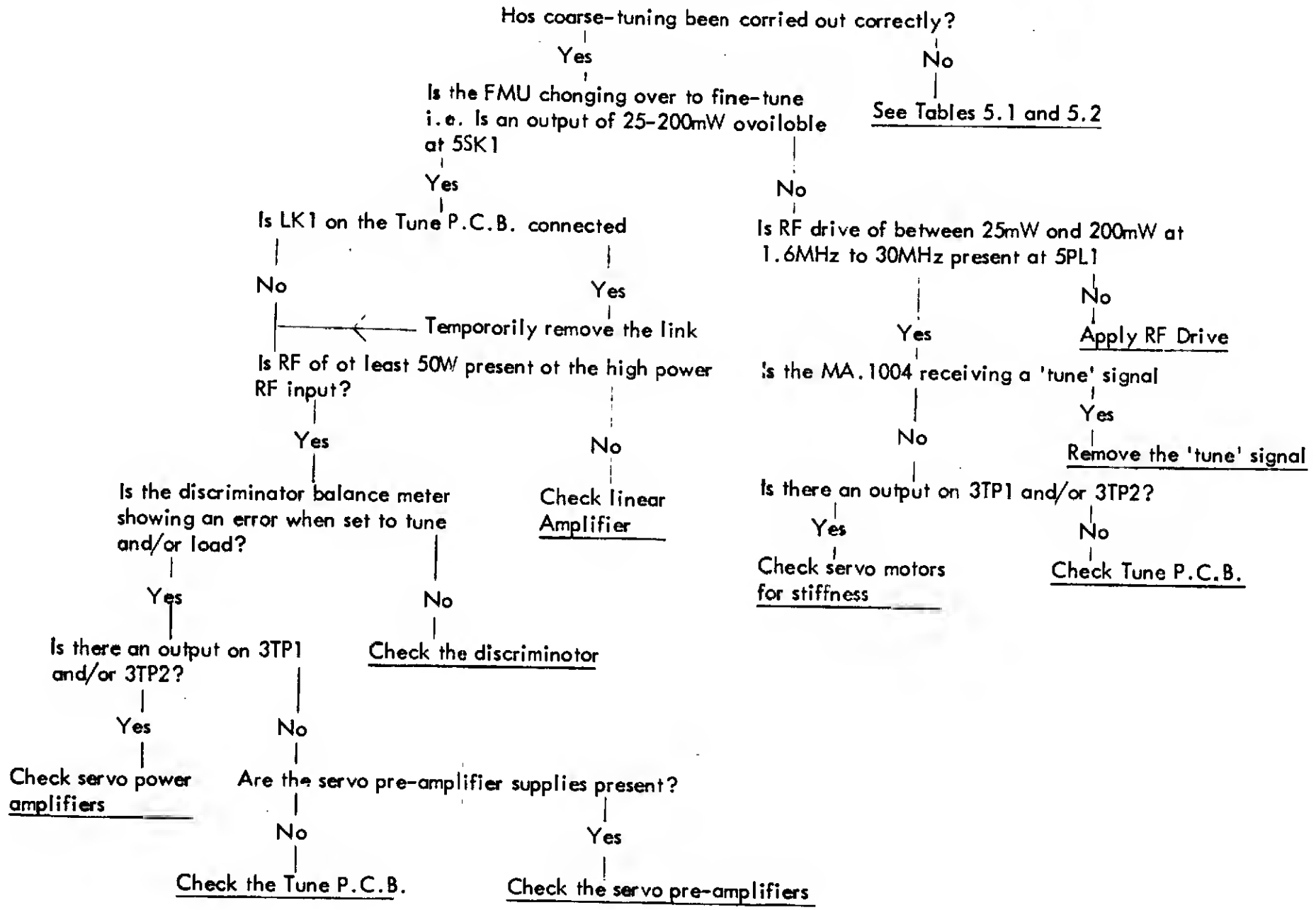
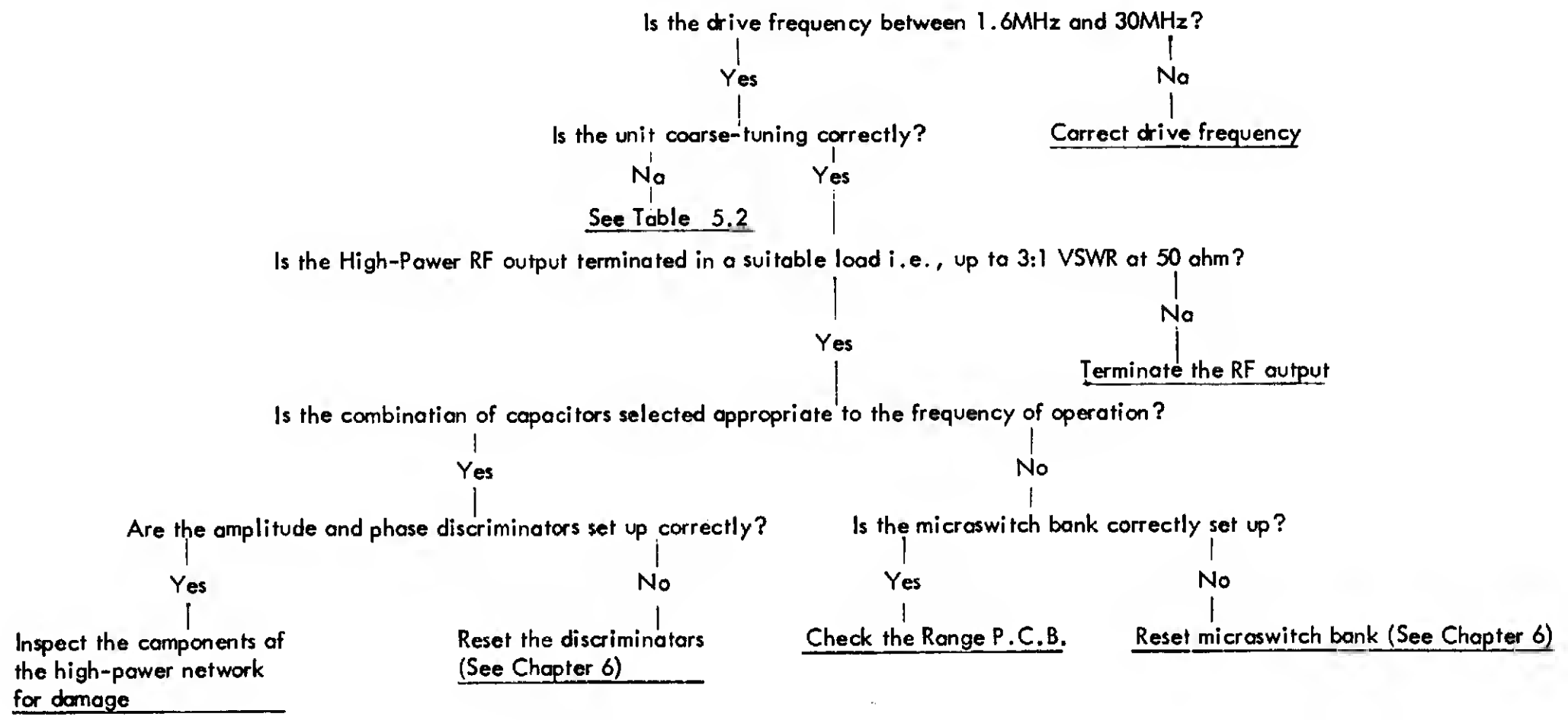


TABLE 5.4

SERVOS WILL NOT FINE-TUNE CORRECTLY



CHAPTER 6

MAINTENANCE

INTRODUCTION

1. This Chapter covers the routine maintenance procedures for the FMU, and the mechanical and electrical alignment procedures. The relevant alignment procedures should be used when assemblies are replaced after overhaul, or if the fault location procedure indicates mal-aligned component.

ROUTINE MAINTENANCE

2. The following procedure should be carried out at regular intervals.

Mechanical

3. Coil and Gearbox

Examine the spur gears periodically and lubricate if necessary with a high temperature lithium-based grease such as Esso Beacon 325.

4. Air Filter

The air intake filter mounted on the hinged panel should be removed at regular intervals and cleaned by washing in warm soapy water. Ensure that the filter is completely dry before replacement.

Electrical

5. Check the positive and negative stabilized supplies at regular intervals (test points 2TP1 and 2TP2 on the power supply unit). The method of adjustment is described under 'Realignment' (para. 12).

MECHANICAL RE-ALIGNMENT

6. Whenever a coil and gearbox is removed, it is necessary to realign the counter and drive assembly (para. 9) and to reset the coarse tune tracking (para. 15). In addition, when the 'tune' coil (IL1) and gearbox is removed, it is necessary to realign the microswitch bank coupling and operating cams.

7. The mechanical re-alignment procedure is carried out with all power removed from the FMU.

Cail and Gearbox

8. The following pracedure is applicable to each inductor and gearbox, and is carried aut with the assembly on the bench.

(1) Slacken the grub screw securing the gearbox micraswitch striker arm and ensure that the arm is free to move on its shaft.

(2) Rotate the cail shaft manually until the rator reaches the mechanical stop at the gearbox end of the shaft, ensuring that the air-spaced variable capacitor does not reach the limit af its travel.

(3) Check that the tips af vanes of the air spaced variable capacitor are approximately 3mm. fram complete engagement. If positioning is incorrect remove the terminal black from the gearbox assembly to gain access ta the solid caupling between the capacitor and gearbox. Slacken the twa grub screws securing the capacitor shaft and rotate the capacitar to achieve the abave candition. Tighten the two grub screws to lack the capacitor.

(4) Rotote the cail until the rator is equal-distance fram the two mechanical end staps, (total mechonical trovel is approximately 36 turns) then move the microswitch striker arm until it lies midway between the two microswitches. Tighten the grub screw to lack the striker arm in pasition.

(5) Rotate the coil shaft until the rotor reoches o quarter turn from the mechonical stop at the apposite end of the coil from the gearbox. Adjust the striker screw for microswitch SA so that the switch just operates and lock the screw.

(6) Ratate the coil shaft until the rator reaches a quarter turn from the mechonicol stop at the gearbax end of the coil. Adjust the striker screw for micraswitch SB so that the switch just operates and lock the screw.

(7) The cail and gearbox assembly is naw mechanically aligned and ready for fitting into the unit.

Caunter and Drive Assembly

9. The counter and drive assembly should be aligned in canjunction with its associated coil and gearbox, as follows.

(1) Wind the appropriate drive handle anticlockwise until the rotor reaches the mechanical end-stop.

(2) Ratate the handle clackwise until the rotor cantacts are adjacent ta the fixed shorting link on the cail assembly. If the counter indicates 100 it is correctly aligned.

(3) If the reading is not 100, proceed as follaws:-

(4) Remove the four screws fixing the counter and drive assembly to the sub front panel and withdraw the caunter and drive, taking care to support the drive coupling block.

(5) Remove the block.

(6) Wind the handle until the counter reads 100 and check that the rectangular metal drive black then lies with its main axis at 90° ta the axis of the driven block.

(7) If the drive black position is incorrect slacken the grub screw securing the large bevel gear and rotate the gear relative ta the shaft to achieve this condition. Note: Take care not to avermesh the gear. Tighten the grub screw to lock the gear.

(8) Replace the drive coupling black and the caunter and drive assembly and then recheck that the counter reads 100.

Microswitch Bank Coupling

10. Realignment of the coupling between the coil and georbox and the microswitch bank should only be necessary when either unit hos been removed and the relationship between the gearbox shaft ond the coupling hos been disturbed.

(1) Before refitting the coil ond gearbox, slacken the grub screws in the caupling and slide the coupling to the bottom of the microswitch bonk shoft.

(2) When the coil and gearbox has been refitted, remove the rear and side access covers and slide the coupling up the shaft until it is fitted ta an equal distance an both shafts.

(3) Rotate the coupling until it lies in such a positian that when the coil rator is moved from end ta end, all four grub screws will be accessible through the rear cover. Tighten the two grub screws an to the coil and gearbax shaft.

(4) Remove the side access cover and rotate the micraswitch bank shaft sa that all the cam securing grub screws will be accessible when the cail rotor is rotated throughout its complete range. Tighten the remainder af the grub screws in the coupling.

(5) Replace the rear access cover.

NOTE: Whenever the microswitch bank coupling is disturbed, the electrical realignment procedure (para. 16) must be carried out.

Servo Pre-Amplifiers Adjustment

14. The balance of the servo Pre-Amplifiers is adjusted as fallows, with the FMU on a bench.

(1) Connect the FMU ta a mains supply and select Auto an the MANUAL Range Switch. Da nat apply an RF input.

(2) Remove the control unit caver and unplug the Tune PCB. Make a link between 3CTR19 collector and emitter. Replace the Tune PCB and unplug the Tune servo pre-amplifier pcb. Replace the servo pre-amplifier using the test extension board.

(3) Switch on the FMU.

(4) Connect an electranic voltmeter set to +10V d.c. range to the R10, R14, R15 junction (negative lead to earth) and check that a zero valtage is indicated. If incorrect, adjust R4 to suit, increasing meter sensitivity as necessary.

(5) Set meter to 10V d.c. and connect the positive lead to TP1.

(6) Connect the negative lead to TP2 and check that the indication is zero. If incorrect adjust R19 increasing sensitivity as necessary.

(7) Switch off, remove test gear and replace covers unless further tests are to be carried out.

Caarse-Tune Tracking

15. The coarse-tune tracking is adjusted as follaws.

(1) Check the caarse tune discriminator input level if there is any daubt about its accuracy (refer ta para.13).

(2) With the FMU on the bench, set the range switch ta AUTO, and connect 1PL1 ta a power supply.

(3) Cannect an RF signal generator to 5PL1 and adjust it ta deliver between 25 and 200mW at 1.6MHz.

(4) If the readings are other than 125, use the special type G potentiometer adjusting tool, and adjust the appropriate patentiometer 6AR7 via the access hole in the left side of the unit far 'tune' and the right side far 'load' to give caunter indicatians of 126 in both cases.

(5) Adjust the signal generator frequency to 30MHz. The two servo systems should run until the counters read 200. If the readings are other than 200

adjust the oppropriate trimmer capacitor(s) 6AC1 via the same side occess holes to bring both indicotors to 200.

(6) Repeot operations (4) ond (5).

Microswitch Cam Alignment

16. Before adjusting the microswitch coms, the coorse tune trocking should be checked (pora.15).

(1) Corry out operotions 15(2) and (3), but odjust the signal generator frequency to 1.75MHz. Allow the servo system to coarse tune.

(2) Remove the side occess cover, slacken the grub screw in the bottom com ond adjust its position so that the oppropriote microswitch is just operoted (listen for click). Ensure that this com connot operate the odjacent microswitch. Lock com.

(3) Adjust the signal generotor frequency obove and below 1.75MHz and check that the switch makes and breaks either side of 1.75MHz.

(4) Repeot operation (3) ot 2.0MHz adjusting the second cam.

(5) Repeat operation (3) ot 2.5MHz adjusting the third cam.

(6) Repeat operation (3) ot 3.1MHz odjusting the fourth cam.

(7) Repeot operation (3) ot 4.0MHz adjusting the fifth cam.

(8) Repeat operation (3) ot 7.5MHz adjusting the sixth com.

(9) Repeat operotion (3) ot 12.0 MHz adjusting the seventh com.

Alignment of Fine-Tune Discriminotors

17. The fine tune discriminators con only be oligned when the FMU is connected in the associoted Lineor Amplifier/Cobinet ossembly. A suitable RF signal generotor, 50 ohm dummy load with meter capoble of hondling the linear omplifier output power, ond on instrument to meosure in-line reflected power up to 500W (e.g. Bird Thruline with 1kW plug-in heod) is required.

(1) Ensure all power is off. Remove the Fine-Tune Discriminator unit cover. Set Potentiometer 4AR16 to the fully onti-clockwise position.

(2) Connect the retlected power meter in the cooxiol coble connected to the input of the FMU.

IMPORTANT NOTE: The additional cable used to connect the instrument should be kept as short as possible.

(3) Terminate the system output in the 50 ohm dummy load.

(4) Connect the RF signal Generator ta the input of the linear Amplifier and adjust its autput to 10 MHz and autput level to between 25 and 200mW.

(5) Set the FMU range switch to 7.5 - 12MHz and the Line switch to LINE 1.

(6) Refer to the coarse-tune graph (fig. 1) and set the tune and load controls to the 10MHz position.

(7) Switch on all the power and manually tune the FMU for minimum reflected power. Nate the autput (forward) pawer.

(8) Switch to LINE 2, retune the FMU, n ate the output pawer.

(9) Repeat operation (8) for LINES 3 and 4.

(10) Select the line which gove maximum output power and retune the FMU for minimum reflected power.

(11) Set the switch on the discriminotor unit to TUNE ond odjust 4AR4 on the Discriminotor PC Board to obtain a centre zero indication on the meter.

(12) Set the switch on the discriminator unit to LOAD and adjust 4AR10 on the Discriminator PC Boord to obtoin a centre zero indication on the meter.

(13) Set the MANUAL switch to AUTO.

(14) Disconnect the signal generator.

(15) Press the TUNE button.

(16) Adjust the signal generator frequency ta 3MHz, and re-cannect it.

(17) Allow FMU to tune (READY lomp illuminated) then set the MANUAL switch to SERVOS OFF.

(18) If RF power output of transmitter is 820W ar above, no further action is required.

(19) If RF power autput is below 820W adjust the TUNE manual control to give 820W autput.

(20) Set METER switch on the discriminator to OFF and carefully note needle position (which may not be exactly central).

(21) Set METER switch to TUNE ond adjust voriable resistor 4AR16 until needle is ot the some position os noted in operotion (20).

(22) Set MANUAL switch to AUTO.

(23) Switch off, remove test equipment and replace covers.

CHAPTER 7

DISMANTLING AND REASSEMBLY

INTRODUCTION

1. The Dismantling and Reassembly instructions detailed in the following paragraphs assume that the Feeder Matching Unit has been isolated fram all electrical supplies and removed fram the Transmitter Terminal Cabinet to a suitable bench.

REMOVAL AND REPLACEMENT OF UNITS

Contral Unit

Removal

2. (1) Place the feeder Matching Unit an its side.

(2) Remove the four Control Unit fixing screws from the bottom panel.

(3) Place the MA.1004 on its base and lower the front panel.

(4) Remove the sockets moting with plugs 3PL1 and 3PL2.

(5) Remove the 2 fixing screws ot the top of the Contral Unit cover.

(6) Remove the 2 fixing screwsot the top of the AUTO/MANUAL switch mounting plate.

(7) Release the retaining arms at each side of the MA.1004 panel and lower the frant panel to its fullest extent.

(8) Remove the Contral Unit by sliding it forward and tilting it slightly to clear the lower flange of the MA.1004.

Replacement

3. (1) Replace the Control Unit in the MA.1004.

(2) Replace but da nat tighten the 4 frant panel fixing screws.

(3) Place the unit an its side and replace but do not tighten the 4 fixing screws an the bottom panel.

(4) Tighten the frant panel fixing screws.

(5) Tighten the battom panel fixing screws.

Counter and Drive Assemblies

Removal

CAUTION: A COUNTER AND DRIVE ASSEMBLY MUST NOT BE REMOVED WHEN AN RF INPUT IS APPLIED TO THE FMU.

4. (1) Remove the top cover of the Feeder Matching Unit.

(2) Lawer the frant panel and remove the 4 fixing screws securing the appropriote ossembly.

(3) Remove the Counter and Drive Assembly ensuring thot the drive coupling daes not fall down inside the unit

Replocement

5. Replacement of a Counter ond D ive Assembly is effected by reversing the procedure detoiled in paro. (1) to (3). Before replacing an assembly refer to the Re-olignment Procedure detailed in Chapter 6 pora.9.

Power Supply

Removal

6. (1) Remove the top cover af the MA.1004

(2) Lower the front ponel and disconnect the socket moting with 2PL1.

(3) Remave the 4 Power Supply Unit fixing screws locoted neor each corner of the aperture far the circuit breakers 2CB1, 2CB2 and 2CB3.

(4) Remove the 2 screws at the bottam rear af the Pawer Supply Unit, ond disconnect the RF autput cable braid from the right hand side of the unit.

(5) Slide the Power Supply back to its fullest extent and lift it aut, frant first, fram the MA.1004.

(6) Ta obtain occess to the Power Supply companents, place the Pawer Supply Unit on a bench, remave the five cover securing screws on each side of the unit and lift off the caver.

Replocement

7. Replace the Power Supply by reversing the procedures in 6(1) to 6(5).

Loading Cail and Gearbax Assembly

Remaval

8. (1) Remave the Pawer Supply Unit, refer ta para.6.

(2) Refer ta para.4 and remove Counter and Drive Assembly.

(3) Disconnect the RF autput cable.

(4) Slacken aff the fanning strip securing screws and remave the fanning strip.

(5) At the capacitor bank, discannect the strap cannected between the capacitor bank and the loading cail.

(6) Suppart the cail and remove the 6 screws securing the assembly ta the side member.

(7) Lift the assembly clear fram the Feeder Matching Unit.

Replacement

9. (1) Return the Laading Cail and Gearbox Assembly to its position in the MA.1004

(2) Support the cail and replace but do nat tighten the 6 screws securing the assembly ta the side member.

(3) Replace the Caunter and Drive Assembly.

(4) Slide the Cail and Gearbax farward ta its fullest extent ta engage the caupling and tighten the 6 screws securing the assembly ta the side member.

(5) Replace the strap cannected between the capacitar bank and the laading cail.

(6) Replace the fanning strip.

(7) Replace the RF autput cable and the silver plated fixings.

(8) Replace the Pawer Supply Unit; refer ta para.7.

(9) Re-align the Caunter and Drive Assembly (Chap.6 para.9)

(10) Carry aut the Coarse-Tune Tracking pracedure (Chap.6 para.15)

Tuning Coil ond Georbox Assembly

Removol

10. (1) Remove the Power Supply Unit, refer to para.6.

(2) Disconnect the coil end of the strop fram the Discriminatar Unit.

(3) Remove the strap connected to the capacitor bank.

(4) Slacken off the fanning strip securing screws and remove the fanning strip.

(5) Remove the access cover an the reor panel of the MA.1004.

(6) Look through the access hole in the rear ponel ta lacate the coupling ta the micraswitch bank.

(7) Loosen the twa bottom 6-32 UNC grub screws an the caupling, ratating the Tune Cantrol to locote the screws.

(8) Remove the Counter and Drive Assembly, refer ta paro.4.

(9) Support the coil ond remove the 6 screws securing the ossembly to the side member.

(10) Lift the assembly from the Feeder Motching Unit.

Replacement

11. (1) Return the Tuning Coil and Gearbox ossembly to its pasition in the MA.1004 and ensure thot the caupling motes with the microswitch bank shoft. Do not tighten the grub screws.

(2) Replace but do not tighten the 6 screws securing the ossembly to the side member.

(3) Replace the Caunter and Drive Assembly.

(4) Slide the Coil and Gearbax farward ta its fullest extent and tighten the 6 screws securing the assembly ta the side member.

(5) Re-align the Caunter and Drive Assembly (Chop.6 paro.9)

(6) Re-align the Micraswitch Bank mechanically (Chop.6 paro.10).

(7) Reploce the straps and fanning strip removed in (3), (4) and (5) respectively.

(8) Replace the Pawer Supply Unit, refer ta para.7.

(9) Carry out the Caarse-Tune Tracking Pracedure (Chap.6 para.15)

(10) Carry aut the Electrical Microswitch Bank Alignment Pracedure (Chap.6 para.16).

(11) Switch aff and replace cavers.

Discriminator Unit

Remaval

12. (1) Remave the top cover af the MA.1004

(2) Remave the Pawer Supply Unit, refer ta para.6.

(3) Discannect the strap between the Discriminatar and the Tuning Coil.

(4) Lawer the front panel and remave the Discriminator Unit caver.

(5) Use a soldering iran to remove the cannections ta pins 3,4,6 and 7 af the PCB, nating their positions for replacement.

(6) Release the retaining arm on the left hand side of the front panel and lower the frant ponel ta its fullest extent.

(7) Remove the fixing screws securing the unit and withdraw it from the MA1004.

Replacement

13. Replacement af the Discriminatar Unit is effected by reversing the pracedures detailed in paro.12(1) ta (7).

Capacitor Bank

Remaval

14. (1) Remave the tap caver af the MA1004

(2) Remove the strap cannecting the capacitar bank to the Tuning Cail.

(3) At the capacitar bank disconnect the strap ta the Laading Cail.

(4) Remave the 4 carner fixing screws and lift the capacitar bank aut fram the MA.1004.

Replocement

15. To reploce the capacitor bank reverse the procedures detoiled in pora.14(1) to (4).

Microswitch Bank

Removol

16. (1) Remove the occess cover on the rear panel,

(2) Rotate the tune control to locate the screws in the coupling and slocken only the bottom 2 6-32UNC grub screws in the coupling.

(3) Ploce the MA.1004 on its right hand side (os viewed from front).

(4) Remove the bottom ponel.

(5) Disconnect the fanning strip from the microswitch bank.

(6) Remove the 4 fixing screws ond remove the microswitch bonk.

Replacement

17. Replacement af the micraswitch bank is effected by reversing the procedures detailed in para.16(1) ta (6). Before tightening the grub screws in the caupling refer to the Relalignment Mechanical ond Electrical Procedures detailed in Chap.6 paras 10 and 16.

Capacitor Bank Solenaids 1RLA to 1RLD

Removal

18. (1) Remave the capacitor bank, refer to pora.14.

(2) Remove the bottom cover ond disconnect the two wires to the oppropriote solenoid.

(3) Remove the two screws securing the solenoid to the platform ond remove the solenoid.

Replacement

19. Replocement of a copocitor bonk solenoid is effected by reversing the procedures detailed in pora.18(1) to (3).

Coil Solenoids 1RLE ond 1RLF

20. (1) Remove the oppropriate Coil ond Gearbox Assembly, pora. 8 ar 10

(2) Remove the bottom cover and disconnect the two wires to the solenoid,

(3) Remove the twa fixing screws and remove the solenoid.

NOTE: Solenoids 1RLE and 1RLF corry insuloting cops ot the end of the plungers; solenaids 1RL2 to 1RLD da not. All salenoids ore otherwise identical.

Replacement

21. Replacement of o coil salenaid is effected by reversing the procedures detoiled in pora.20 (2) ond (3) and referring to the replacement procedure for the appropriate Coil and Gearbox Assembly.

CHAPTER 8

COMPONENTS LIST

Cct. Ref.	Value	Description	Rat	Tal %	Racal Part Number	Manufacturer
			MAIN CHASSIS			
	Resistors Ohms		W			
1R1	470	Metal Oxide		2	918030	Electrasil TR5
	Capacitars F		V			
1C1	510p		6k	5	920702	LCC AAU055
1C2	390p		5k	5	920701	LCC AAU042
1C3	100p		5k	5	920703	LCC AAH042
1C4	82p		7k	5	920700	LCC AHH 042
1C5	82p		7k	5	920700	LCC AAH042
1C6	5p	Ceramic	4k	10	917977	Plessey 10
1C7	270p	Silver Mica	350	2	902171	Lemca MS611-I-R-270
	Inductors					
1L1		See page8-23(Part af Cail, Motar and Gearbax Assembly)				
1L2		See page8-23(Part af Coil, Motar and Gearbax Assembly)				
	Indicatar Lamps					
1LP1		Lamp Filament	24V		921899	Hivac
1LP2		Lamp Filament	24V		921899	Hivac
1LP3		Lamp Filament	24V		921899	Hivac
1LP4		Lamp Filament	24V		921899	Hivac
	Plugs					
1PL1		Supply input			915655	Amphenal 62GB-57A8-3.3p
	Sackets					
1SK1		Connectar			917555	Transradia C4/5CH
1SK2		Bulkhead receptacle			900061	Transradia BN12/5
1SK4					915970	Cannon DB25S
1SK5					915970	Cannon DB25S
1SK6					900905	Cannon DA15S
1SK7					900905	Cannon DA15S
1SK8					900905	Cannon DA15S
1SK9					915970	Cannon DB25S

Cct. Ref.	Value	Description	Ratio	Tol %	Racal Part Number	Manufacturer
		MAIN CHASSIS (Cont'd)				
	Salenaids					
1RLA					603285	
1RLB					603285	
1RLC					603285	
1RLD					603285	
1RLE					603285	
1RLF					603285	
	Switches					
1SA		Supply, micra key			915362	TMC S526893
1SB		Tune, push button			906678	TMC S325595
	Miscellaneous					
1TS1		Fanning strip			922218	Carr 44/77/534/8LH
1TS2		Fanning strip			922219	Carr 44/77/534/8RH
1TS3		Fanning strip			921445	Klippon MF2/12-2417
		Adaptor, by-poss (used when MA.1004 is by-passed)			901735	Transradia C3/5A
		Cantact capacitars 1C1 ta 1C5			603281	
		Lamphalder, 1LP3 & 1LP4			917200	TMC S527266
		Knab far indicatar lamps			914256	TMC S528914
		Diffuser far indicator lamps			915980	TMC S531962
		Clear lens far indicator lamps			915959	TMC S528926
		Filter, Green for indicatar lamps			921657	TMC S531412
		Filter, Red far indicator lamps			921658	TMC S531410
		Filter, Amber for indicator lamps			922428	TMC S531411

Cct. Ref.	Value	Description	Rat	Tol %	Rocal Part Number	Manufacturer
		POWER SUPPLY UNIT (MS448 and PS57) DA603514				
	Resistors ohm		W			
2R1	2.2	Wirewound	9	5	922033	Welwyn W23
2AR1	120	Metal Oxide		5	906021	Electrasil TR5
2AR2	2.2k	Metal Oxide		5	908270	Electrasil TR4
2AR3	4.7k	Metal Oxide		5	900989	Electrosil TR4
2AR4	1k	Metal Oxide		5	908267	Electrosil TR4
2AR5	1k	Metal Oxide		5	908267	Electrosil TR4
2AR6	4.7k	Metal Oxide		5	900989	Electrasil TR4
2AR7	2.2k	Metal Oxide		5	908270	Electrosil TR4
2AR8	560	Metal Oxide		5	909841	Electrosil TR4
2AR9	560	Metal Oxide		5	909841	Electrosil TR4
2AR10	1	Wirewound	2.5	5	917137	Welwyn W21
2AR11	4.7	Wirewound		5	917145	Welwyn W21
2AR12	1.2k	Metal Oxide		5	908285	Electrasil TR4
2AR13	10k	Metal Oxide		5	900986	Electrosil TR4
2AR14	10k	Metal Oxide		5	900986	Electrasil TR4
2AR15	1k	Metal Oxide		5	908267	Electrasil TR4
2AR16	1.2k	Metal Oxide		5	906346	Electrasil TR4
2AR17	1.2k	Metal Oxide		5	906346	Electrosil TR4
2AR18	2.2k	Metal Oxide		5	908270	Electrosil TR4
2AR19	2.2k	Metal Oxide		5	908270	Electrasil TR4
2AR20	2.2k	Metal Oxide		5	908270	Electrosil TR4
2AR21	2.2k	Metal Oxide		5	908270	Electrosil TR4
2AR22	330	Metal Oxide		5	908268	Electrosil TR4
2AR23	2.2k	Voriable			920518	Plessey MPWT
2AR24	2.2k	Metal Oxide		5	908270	Electrosil TR4
2AR25	2.2k	Metal Oxide		5	908270	Electrosil TR4
2AR26	2.2k	Variable			920518	Plessey MPWT
2AR27	330	Metal Oxide		5	908268	Electrasil TR4
	Capacitars F		V			
2C1	3300µ	Electrolytic	63		921301	Mullard 106 18332
2C2	3300µ	Electralytic	63		921301	Mullard 106 18332
2AC1	0.1µ	Fixed	100	20	914173	ITT, PMC2R
2AC2	0.1µ	Fixed	100	20	914173	ITT, PMC2R
2AC3	16µ	Electralytic	64		921662	Mullard C428ARH16
2AC4	16µ	Electrolytic	64		921662	Mullard C428ARH16
2AC5	.01µ	Fixed	25	+50 -25	911845	Erie 831T

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		POWER SUPPLY UNIT (Cont'd)				
	Capacitors (Cont'd)					
	F		V			
2AC6	.01µ	Fixed	25	+50 -25	911845	Erie 831T
2AC7	.01µ	Fixed			920713	PMC 2R0.01K400
2AC8	.01µ	Fixed			920713	PMC 2R0.01K400
2AC9	2.5µ	Electralytic			921663	Mullard C428ARH2.5
2AC10	2.5µ	Electralytic			921663	Mullard C428ARH2.5
2AC11	.01µ	Fixed	25	+50 -25	911845	Erie 831T
2AC12	.01µ	Fixed	25	+50 -25	911845	Erie 831T
2AC13	.01µ	Fixed	25	+50 -25	911845	Erie 831T
2AC14	.01µ	Fixed	25	+50 -25	911845	Erie 831T
	Transformers					
2T1		Mains			CT603517	
	Diodes					
2D1		4S820			921300	
2D2		4S820			921300	
2AD1		IN4149			914898	
2AD2		IN4149			914898	
2AD3		8ZY88C18			915920	
2AD4		8ZY88C18			915920	
	Transistors					
2TR1		2N3055			915654	
2TR2		2N5194			923704	
2ATR1		8SV68			921608	
2ATR2		2N2484			908970	
2ATR3		2N2484			908970	
2ATR4		8SV68			921608	
2ATR5		8FY51			908753	
2ATR6		8C107			911929	
2ATR7		8CY71			911928	
2ATR8		8SV68			921608	
	Circuit Breakers					
2C81					921660	Highland APL1-1-6-2-252
2C82						Highland APL1-4-5-2-252
2C83					921661	Highland APL1-5-2-252

Cct. Ref.	Volue	Description	Rat	Tol %	Racal Part Number	Manufacturer
		POWER SUPPLY UNIT (Cont'd)				
	Plugs					
2PL1					909729	Cannon DA15P
	Sockets					
2SK1	(TP1) Yellow 2mm				916023	Belling Lee L1737
2SK2	(TP2) Yellow 2mm				916023	Belling Lee L1737

Cct. Ref.	Volue	Description	Rat	Tol %	Rocol Port Number	Monufocturer
			CONTROL UNIT (MS450) DA603422			
	Resistors					
	ohm		W			
3R1	22	Wirewound	6	5	903702	Welwyn W22
3R2	680	Metol Oxide		5	908390	Electrosil TR4
3AR1	470	Metol Oxide		5	900992	Electrosil TR4
3AR2	470	Metol Oxide		5	900992	Electrosil TR4
3AR3	Not Used					
3AR4	470	Metol Oxide		5	900992	Electrosil TR4
3AR5	470	Metal Oxide		5	900992	Electrosil TR4
	Copocitors					
	F		V			
3C1	1µ	Fixed			915370	PMC 2R/1.0/M100
3AC1	1000p	Fixed	500	20	915243	Erie 831
3AC2	1000p	Fixed	500	20	915243	Erie 831
3AC3	1000p	Fixed	500	20	915243	Erie 831
3AC4	1000p	Fixed	500	20	915243	Erie 831
3AC5	1000p	Fixed	500	20	915243	Erie 831
3AC6	0.1µ	Fixed		20	914173	PMC 2R/0.1/M100
3AC7	0.1µ	Fixed		20	914173	PMC 2R/0.1/M100
	Inductors					
3L1	10µH				922281	Combion 2960-40-02
	Diodes					
3AD1		IN4149			914898	Mullord
3AD2		IN4149			914898	Mullard
2AD3		IN4149			914898	Mullard
	Transistors					
3TR1		2N3055			915654	Mullord
	Switches					
3SA		Rotary			BD603757	
3SB		Toggle, block			921672	Arrow TS3BP
3SC		Rotory			BD603758	
	Reloys					
3RLA					922076	Plessey 507/1/02196/004

Cct. Ref.	Value	Description	Rat	Tol %	Racol Part Number	Monufocturer
			CONTROL UNIT (Cont'd)			
	Plugs					
3PL1					916489	Connon DP25P
3PL2					916489	Cannon DP25P
	Sockets					
3SK1	(TP1)	Yellow 2mm			916023	Belling Lee L1737
3SK2	(TP2)	Yellow 2mm			916023	Belling Lee L1737
3ASK1					917087	Varicon 8129-015-603-002
3ASK2					917087	Varicon 8129-015-603-002
3ASK3					919406	Varicon 8131-032-603-003
3ASK4					919406	Varicon 8131-032-603-003

Cct. Ref.	Value	Description	Rot	Tol %	Racol Port Number	Manufacturer
		RANGE P.C. BOARD (PS60) ED 603645				
	Resistors ohms		W			
3BR1	3.9k	Metol Oxide		5	900990	Electrosil TR4
3BR2	1k	Metal Oxide		5	90B267	Electrosil TR4
3BR3	1M	Metol Oxide		5	914036	Electrosil TR5
3BR4	56	Metol Oxide		5	9082B9	Electrosil TR4
3BR5	220k	Metol Oxide		5	917454	Electrosil TR4
3BR6	220k	Metol Oxide		5	917454	Electrosil TR4
3BR7	47k	Metal Oxide		5	90B391	Electrasil TR4
3BR8	56	Metal Oxide		5	90B2B9	Electrosil TR4
3BR9	470k	Metal Oxide		5	905577	Electrasil TR4
3BR10	120k	Metol Oxide		5	90B2B6	Electrasil TR4
3BR11	15k	Metol Oxide		5	90B280	Electrosil TR4
3BR12	47k	Metol Oxide		5	908391	Electrasil TR4
3BR13	56	Metol Oxide		5	90B2B9	Electrasil TR4
3BR14	470k	Metol Oxide		5	905577	Electrosil TR5
3BR15	68k	Metol Oxide		5	908279	Electrosil TR4
3BR16	1k	Metol Oxide		5	90B267	Electrosil TR4
3BR17	3.3k	Metol Oxide		5	900991	Electrosil TR4
3BR1B	1k	Metal Oxide		5	90B267	Electrosil TR4
3BR19	6.6k	Metal Oxide		5	90B273	Electrosil TR4
3BR20	1B0	Metal Oxide		5	909125	Electrosil TR4
3BR21	180	Metol Oxide		5	909125	Electrosil TR4
3BR22	1k	Metal Oxide		5	908267	Electrosil TR4
3BR23	1B0	Metol Oxide		5	909125	Electrosil TR4
3BR24	1k	Metol Oxide		5	90B267	Electrosil TR4
3BR25	1B0	Metal Oxide		5	909125	Electrosil TR4
3BR26	1k	Metal Oxide		5	90B267	Electrosil TR4
3BR27	1B0	Metal Oxide		5	909125	Electrosil TR4
3BR2B	1k	Metal Oxide		5	90B267	Electrosil TR4
3BR29	1B0	Metal Oxide		5	909125	Electrosil TR4
3BR30	1k	Metal Oxide		5	90B267	Electrosil TR4
3BR31	1B0	Metal Oxide		5	909125	Electrasil TR4
3BR32	1k	Metol Oxide		5	90B267	Electrasil TR4
3BR33	1B0	Metal Oxide		5	909125	Electrasil TR4
3BR34	1k	Metal Oxide		5	90B267	Electrosil TR4
3BR35	680	Metal Oxide		5	90B390	Electrasil TR4
3BR36	4.7k	Metal Oxide		5	9009B9	Electrasil TR4

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		RANGE P.C. BOARD (Cont'd)				
	Capacitors F		V			
3BC1	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC2	1µ	Fixed		20	915370	ITT PMC2R/1.0/M100
3BC3	1µ	Fixed	20	20	915370	ITT PMC2R/1.0/M100
3BC4	1µ	Fixed		20	915370	ITT PMC2R/1.0/M100
3BC5	1µ	Fixed		20	915370	ITT PMC2R/1.0/M100
3BC6	.01µ	Fixed		20	914171	ITT PMC2R/.01/M400
3BC7	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC8	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC9	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC10	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC11	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC12	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC13	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC14	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC15	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC16	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC17	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC18	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC19	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC20	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC21	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC22	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC23	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC24	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
3BC25	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
	Transistors					
3BTR1		BFY51			908753	Mullard
3BTR2		BCY71			911928	Mullard
3BTR3		BFX29			915267	Mullard
3BTR4		BC107			911929	Mullard
3BTR5		BFY51			908753	Mullard
3BTR6		BCY71			91192B	Mullard
3BTR7		BCY71			911928	Mullard
3BTR8		BFX29			915267	Mullard
3BTR9		BC107			911929	Mullard
3BTR10		BCY71			911928	Mullard
3BTR11		BC107			911929	Mullard
3BTR12		BFY51			908753	Mullard
3BTR13		BCY71			911928	Mullard

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		RANGE P.C. BOARD (Cont'd)				
		Diodes				
3BD1		BZY88C5V6			912747	Mullard
3BD2		BZY88C5V6			912747	Mullard
3BD3		BZY88C5V6			912747	Mullard
3BD4		BZY88C5V6			912747	Mullard
3BD5		BZY88C5V6			912747	Mullard
3BD6		IN4002			911460	ITT
3BD7		BZY88C5V6			912747	Mullard
3BD8		IN4149			914B98	Mullard
3BD9		IN4149			914B98	Mullard
3BD10		IN4149			914B98	Mullard
3BD11		1N4149			914898	Mullard
3BD12		1N4002			911460	ITT
3BD13		1N4002			911460	ITT
3BD14		1N4002			911460	ITT
3BD15		1N4149			914898	Mullard
3BD16		IN4149			914898	Mullard
3BD17		IN4149			914898	Mullard
3BD18		IN4149			914898	Mullard
3BD19		IN4149			914898	Mullard
3BD20		IN4149			914898	Mullard
3BD21		IN4002			911460	ITT
3BD22		IN4149			914B9B	Mullard
3BD23		BZY8BC10			917217	Mullard
		Silicon Controlled Rectifiers (SCR's)				
3BSCR1		BTX18-100			917837	Mullard
3BSCR2		BTX18-100			917837	Mullard
3BSCR3		BTX18-100			917837	Mullard
3BSCR4		BTX18-100			917837	Mullard
3BSCR5		BTX18-100			917837	Mullard
3BSCR6		BTX18-100			917837	Mullard
3BSCR7		BTX18-100			917837	Mullard
		Plugs				
3BPL1					919362	Varicon 8131-032-610-001

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		TUNE P.C. BOARD (PS59) ED 603642				
	Resistors ohm		W			
3CR1	1k	Metal Oxide		5	908267	Electrosil TR4
3CR2	1k	Metal Oxide		5	908267	Electrosil TR4
3CR3	10k	Metal Oxide		5	900986	Electrosil TR4
3CR4	10k	Metal Oxide		5	900986	Electrosil TR4
3CR5	10k	Metal Oxide		5	900986	Electrosil TR4
3CR6	10k	Metal Oxide		5	900986	Electrosil TR4
3CR7	1M	Metal Oxide		5	914036	Electrosil TR5
3CR8	4.7k	Metal Oxide		5	900989	Electrosil TR4
3CR9	4.7k	Metal Oxide		5	900989	Electrosil TR4
3CR10	15k	Metal Oxide		5	908280	Electrosil TR4
3CR11	10k	Metal Oxide		5	900986	Electrosil TR4
3CR12	33	Metal Oxide		5	908690	Electrosil TR4
3CR13	4.7k	Metal Oxide		5	900989	Electrosil TR4
3CR14	68k	Metal Oxide		5	908295	Electrosil TR4
3CR15	4.7k	Metal Oxide		5	900989	Electrosil TR4
3CR16	1M	Metal Oxide		5	914036	Electrosil TR5
3CR17	4.7k	Metal Oxide		5	900986	Electrosil TR4
3CR18	1k	Metal Oxide		5	908267	Electrosil TR4
3CR19	4.7k	Metal Oxide		5	900989	Electrosil TR4
3CR20	330	Metal Oxide		5	908268	Electrosil TR4
3CR21	150	Metal Oxide		5	909121	Electrosil TR4
3CR22	47k	Metal Oxide		5	908391	Electrosil TR4
3CR23	47k	Metal Oxide		5	908391	Electrosil TR4
3CR24	4.7k	Metal Oxide		5	900989	Electrosil TR4
3CR25	10k	Metal Oxide		5	900986	Electrosil TR4
3CR26	100k	Metal Oxide		5	908293	Electrasil TR4
3CR27	27k	Metal Oxide		5	908295	Electrosil TR4
3CR28	68k	Metal Oxide		5	908295	Electrosil TR4
3CR29	33	Metal Oxide		5	908690	Electrosil TR4
3CR30	10k	Metal Oxide		5	900986	Electrosil TR4
3CR31	1.8k	Metal Oxide		5	908283	Electrosil TR4
3CR32	27k	Metal Oxide		5	908295	Electrosil TR4
3CR33	3.9k	Metal Oxide		5	900990	Electrosil TR4
3CR34	120	Metal Oxide		5	908286	Electrasil TR5
3CR35	47k	Metal Oxide		5	908391	Electrosil TR4

Cct. Ref.	Value	Description	Rot	Tol %	Rocol Part Number	Manufacturer
		TUNE P.C. BOARD (Cont'd)				
	Resistors (Cont'd)					
	ohm		W			
3CR36	470	Metol Oxide		5	900992	Electrosil TR4
3CR37	18k	Metal Oxide		5	908272	Electrosil TR4
3CR38	330	Metol Oxide		5	908268	Electrasil TR4
3CR39	18k	Metal Oxide		5	908272	Electrosil TR4
3CR40	1k	Metal Oxide		5	908267	Electrosil TR4
3CR41	1k	Metal Oxide		5	908267	Electrasil TR4
3CR42	27k	Metol Oxide		5	908295	Electrosil TR4
3CR43	10k	Metol Oxide		5	900986	Electrosil TR4
3CR44	330	Metol Oxide		5	908268	Electrosil TR4
3CR45	330	Metal Oxide		5	908268	Electrosil TR4
3CR46	10k	Metal Oxide		5	900986	Electrosil TR4
3CR47	10k	Metal Oxide		5	900986	Electrasil TR4
3CR48	1k	Metol Oxide		5	908267	Electrosil TR4
	Capacitors					
	F		V			
3CC1	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC2	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC3	33µ	Fixed	63		920534	Mullord 108 18339
3CC4	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC5	6.8µ	Fixed		20	910129	Union Carbide K6R8J35S
3CC6	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC7	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC8	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC9	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC10	100µ	Fixed	63		920246	Mullard 108 18101
3CC11	100µ	Fixed	63		920246	Mullard 108 18101
3CC12	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC13	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC14	100µ	Fixed	63		920246	Mullord 108 18101
3CC15	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC16	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC17	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
3CC18	0.1µ	Fixed		20	914173	STC PMC2R/0.1/M100
	Transistors					
3CTR1		8FY51			908753	Mullard
3CTR2		BFY51			908753	Mullord
3CTR3		8C107			911929	Mullord
3CTR4		BC107			911929	Mullard
3CTR5		BC107			911929	Mullord

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		TUNE P.C. BOARD (Cont'd)				
		Transistors (Cont'd)				
3CTR6		BCY71			911928	Mullard
3CTR7		BCY71			911928	Mullard
3CTR8		BFY51			908753	Mullard
3CTR9		BC107			911929	Mullard
3CTR10		BC107			911929	Mullard
3CTR11		NOT USED				
3CTR12		BFY51			908753	Mullard
3CTR13		BC107			911929	Mullard
3CTR14		BC107			911929	Mullard
3CTR15		BC107			911929	Mullard
3CTR16		BCY71			911928	Mullard
3CTR17		BCY71			911928	Mullard
3CTR18		BFX29			915267	Mullard
3CTR19		BC107			911929	Mullard
3CTR20		BCY71			911928	Mullard
3CTR21		BFX29			915267	Mullard
3CTR22		BFY51			908753	Mullard
3CTR23		BFY51			908753	Mullard
		Diodes				
3CD1		IN4149			914898	Mullard
3CD2		IN4149			914898	Mullard
3CD3		IN4149			914898	Mullard
3CD4		BZY88C18			915920	Mullard
3CD5		IN4002			911460	Texas
3CD6		IN4149			914898	Mullard
3CD7		IN4149			914898	Mullard
3CD8		BZY88C8V2			917622	Mullard
3CD9		IN4002			911460	Texas
3CD10		IN4149			914898	Mullard
3CD11		IN4149			914898	Mullard
3CD12		IN4149			914898	Mullard
3CD13		IN4149			914898	Mullard
3CD14		IN4149			914898	Mullard
3CD15		NOT USED				
3CD16		IN4002			911460	Texas
3CD17		NOT USED				
3CD18		IN4149			914898	Mullard
3CD19		IN4149			914898	Mullard
3CD20		IN4149			914898	Mullard

Cct. Ref.	Value	Description	Rat	Tal %	Racal Part Number	Manufacturer
		TUNE P.C. BOARD (Cont'd)				
	Diodes (Cont'd)					
3CD21		IN4002			911460	Texas
3CD22		IN4149			914898	Mullard
3CD23		BZY88C8V2			917622	Mullard
3CD24		IN4002			911460	Texas
3CD25		IN4149			914898	Mullard
3CD26		BZY88C8V2			917622	Mullard
3CD27		IN4149			914898	Mullard
3CD28		IN4149			914898	Mullard
3CD29		NOT USED				
3CD30		BZY88C8V2			917622	Mullard
3CD31		IN4149			914898	Mullard
	Relays					
3CRLA					921505	Leach ER2-2A A1A
3CRLC					921505	Leach ER2-2A A1A
	Plugs					
3CPL1					919362	Varican 8131-032-610 -001

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		SERVO PRE-AMPLIFIER P.C. BOARD (PS108) CC601093				
		All components are pre-fixed PS108				
	Resistors					
	ohm		W			
R1	10k	Metal Oxide		5	900986	Electrosil TR4
R2	150k	Metal Oxide		5	908277	Electrosil TR4
R3	1k	Metal Oxide		5	908267	Electrosil TR4
R4	100k	Variable		20	916411	Morganite Type 80
R5	100k	Metal Oxide		5	908293	Electrosil TR4
R6	1.2k	Metal Oxide		5	916347	Electrosil TR6
R7	220k	Metal Oxide		5	906025	Electrosil TR5
R8	220k	Metal Oxide		5	906025	Electrasil TR5
R9	22k	Metal Oxide		5	908269	Electrosil TR4
R10	1M	Metal Oxide		5	911692	Electrosil TR5
R11	1k	Metal Oxide		5	908267	Electrosil TR4
R12	1k	Metal Oxide		5	906031	Electrosil TR5
R13	10	Metal Oxide		5	908471	Electrosil TR5
R14	1.5k	Metal Oxide		5	908296	Electrosil TR4
R15	1k	Metal Oxide		5	908267	Electrosil TR4
R16	15k	Metal Oxide		5	908280	Electrosil TR4
R17	51	Metal Oxide		5	912757	Electrasil TR4
R18	2.2k	Metal Oxide		5	908270	Electrosil TR4
R19	10k	Variable		20	916410	Morganite Type 80
R20	10k	Metal Oxide		5	900986	Electrosil TR4
R21	2.2k	Metal Oxide		5	908270	Electrosil TR4
R22	1k	Metal Oxide		5	908267	Electrosil TR4
R23	5.6k	Metal Oxide		5	916348	Electrosil TR6
R24	180	Metal Oxide		5	909125	Electrosil TR4
R25	5.6k	Metal Oxide		5	916348	Electrosil TR6
R26	100	Metal Oxide		5	908276	Electrosil TR4
R27	100	Metal Oxide		5	908276	Electrosil TR4
R28	100	Metal Oxide		5	908276	Electrosil TR4
R29	100	Metal Oxide		5	908276	Electrosil TR4
R30	100	Metal Oxide		5	900986	Electrosil TR4
	Capacitors		(Volts)			
C1	0.01µ	Polyester	250	10	915918	Mullard 344-41103
C2	2.2µ	Electrolytic	50	20	916359	Plessey 402/8/50043/002
C3	0.1µ	Polycarbonate	100	10	915075	Mullard 344-21104
C4	0.47µ	Polycarbonate	100	10	915172	STC PMA 047M100
C5	0.1µ	Polycarbonate	100	10	915075	Mullard 344-21104

Cct. Ref.	Value	Description	Rat	Tol %	Racal Port Number	Manufacturer
		SERVO PRE-AMPLIFIER P.C. BOARD (Cant'd)				
	Capacitors (Contd)		(Volts)			
C6	0.1μ	Polycarbonate	100	10	915075	Mullord 344-21104
C7	0.01μ	Polyester	250	10	915918	Mullord 344-41103
C8	0.1μ	Polycarbonate	100	10	915075	Mullard 344-21104
	Transistors					
TR1		Silicon n-p-n			908753	Mullard BFY 51
TR2		Silicon n-p-n			908753	Mullard BFY 51
TR3		Silicon p-n-p			915497	STC 2N 4033
TR4		Silicon p-n-p			915497	STC 2N 4033
TR5		Silicon n-p-n			915496	STC BSY 56
TR6		Silicon p-n-p			915497	STC 2N 4033
	Diodes					
D1		Zener: 3.3V	400mW	5	912567	Mullard BZY 88 C3V3
D2		Zener 3.3V	400mW	5	912567	Mullord BZY 88 C3V3
D3		Silicon			900651	Mullard 1N 914
D4		Silicon			900651	Mullard 1N 914
D5		Zener: 6.2V	400mW	5	911682	Mullard BZY 88 C6V2
D6		Zener: 6.2V	400mW	5	911682	Mullord BZY 88 C6V2
D7		Zener: 6.2V	400mW	5	911682	Mullard BZY 88 C6V2
	Integroted Circuits					
IC1 (on/A)		Wideband Amplifier			912160	Fairchild uA 702C
IC1 (on/B)		Widebond Amplifier			917285	Fairchild uA 702A
	Connectors					
		15-way PCB Connector			916412	Varican 8129-015-610-001

Cct. Ref.	Value	Description	Rat	Tol %	Racol Part Number	Manufacturer
		FINE TUNE DISCRIMINATOR (MS449&PS56) CA603454				
	Resistors ohm		W			
4R1	10k		7	5	921426	Electrosil FP7
4R2	10k		7	5	921426	Electrosil FP7
4R3	12k	Metal Oxide		5	908274	Electrosil TR4
4R4	15k	Metal Oxide		5	908280	Electrosil TR4
4AR1	18k	Metal Oxide		5	908272	Electrosil TR4
4AR2	39	Metal Oxide		5	906343	Electrasil TR5
4AR3	39	Metal Oxide		5	906343	Electrasil TR5
4AR4	22k	Variable			919816	Plessey MPWT
4AR5	39	Metal Oxide		5	906343	Electrasil TR5
4AR6	39	Metal Oxide		5	906343	Electrosil TR5
4AR7	18k	Metal Oxide		5	908272	Electrosil TR4
4AR8	1k	Metal Oxide		5	908267	Electrosil TR4
4AR9	18k	Metal Oxide		5	908272	Electrosil TR4
4AR10	22k	Variable			919816	Plessey MPWT
4AR11	39			5	922615	Electrosil TR8
4AR12	1k	Metal Oxide		5	908267	Electrosil TR4
4AR13	18k	Metal Oxide		5	908272	Electrosil TR4
4AR14	330	Metal Oxide		5	908153	Electrosil TR5
4AR15		NOT USED				
4AR16	1k	Variable			916051	Morganite 81E
	Capacitors; F		V			
4C1	5p	Ceramic	4k		917977	Plessey 10
4AC1		NOT USED				
4AC2	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
4AC3	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
4AC4	120p	Silver Mica	350	2	902163	Lemco M5611/1/R/120
4AC5	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
4AC6	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
4AC7	120p	Silver Mica	350	2	902163	Lemco M5611/1/R/120
4AC8	0.1µ	Fixed			914173	ITT PMC2R/0.1/M100
4AC9	0.1µ	Fixed			914173	ITT PMC2R/0.1/M100
4AC10	0.1µ	Fixed			914173	ITT PMC2R/0.1/M100
4AC11	0.1µ	Fixed			914173	ITT PMC2R/0.1/M100
	Inductors					
4L1		Coil Assembly			BT603391	
4L2		Coil Assembly			BT603391	
4AL1	10µH	Choke			922364	Combion 550-3640-45-02
4AL2	10µH	Choke			922364	Combian 550-3640-45-02

Cct. Ref.	Value	Description	Rat	Tol %	RacalPart Number	Manufacturer
		FINE TUNE DISCRIMINATOR (Cont'd)				
	Diodes					
4D1		IN4149			914898	Mullard
4D2		IN4149			914898	Mullard
4AD1		IN4149			914898	Mullard
4AD2		IN4149			914898	Mullard
4AD3		IN4149			914898	Mullard
4AD4		IN4149			914898	Mullard
4AD5		IN4149			914898	Mullard
4AD6		IN4149			914898	Mullard
	Switches					
4SA		Toggle, black			921425	Arrow TC38P
	Meter					
4M1		Meter 50-0-50uA			921424	Turner 125E

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		CONSTANT-VOLTAGE AMPLIFIER (MS454 & PS58) DC603545				
	Resistors ohm		W			
5AR1	3.3k	Metal Oxide		5	900991	Electrosil TR4
5AR2	1k	Variable			919805	Plessey MPWT
5AR3	1k	Metal Oxide		5	908267	Electrosil TR4
5AR4	4.7k	Metal Oxide		5	900989	Electrosil TR4
5AR5	2.2k	Metal Oxide		5	908270	Electrosil TR4
5AR6	1k	Metal Oxide		5	908267	Electrosil TR4
5AR7	4.7k	Metal Oxide		5	900989	Electrosil TR4
5AR8	820	Metal Oxide		5	908282	Electrosil TR4
5AR9	10k	Metal Oxide		5	900986	Electrosil TR4
5AR10	1k	Metal Oxide		5	908267	Electrosil TR4
5AR11	1.8k	Metal Oxide		5	908283	Electrosil TR4
5AR12	1.8k	Metal Oxide		5	908283	Electrosil TR4
5AR13	1k	Metal Oxide		5	908267	Electrosil TR4;
5AR14	560	Wirewound	2.5	5	913614	Welwyn W21
5AR15	10	Metal Oxide		5	912868	Electrosil TR4
5AR16	1k	Metal Oxide		5	908267	Electrosil TR4
5AR17	47	Metal Oxide		5	911930	Electrosil TR4
5AR18	51	Metal Oxide		5	912757	Electrosil TR4
5AR19	51	Metal Oxide		5	912757	Electrosil TR4
5AR20	1.8k	Metal Oxide		5	908283	Electrosil TR4
5AR21	1.8k	Metal Oxide		5	908283	Electrosil TR4
5AR22	330	Wirewound	2.5	5	913608	Welwyn W21
5AR23	33	Metal Oxide		5	908690	Electrosil TR4
5AR24	10	Metal Oxide		5	912868	Electrosil TR4
5AR25	330	Metal Oxide		5	908268	Electrosil TR4
5AR26	51	Metal Oxide		5	912757	Electrosil TR4
5AR27	820	Metal Oxide		5	906024	Electrosil TR5
5AR28	4.7k	Metal Oxide		5	900989	Electrosil TR4
5AR29	47	Metal Oxide		5	911930	Electrosil TR4
5AR30	51	Metal Oxide		5	912757	Electrosil TR4
5AR31	120	Metal Oxide		5	906021	Electrosil TR4
5AR32	4.7k	Metal Oxide		5	900989	Electrosil TR4
5AR33	4.7k	Metal Oxide		5	900989	Electrosil TR4
5AR34	47k	Metal Oxide		5	908391	Electrosil TR4
5AR35	1M	Metal Oxide		5	914036	Electrosil TR5
5AR36	15k	Metal Oxide		5	908280	Electrosil TR4
5AR37	120	Metal Oxide		5	906021	Electrosil TR5
5AR38	220k	Metal Oxide		5	917454	Electrosil TR4
5AR39	10k	Metal Oxide		5	900986	Electrosil TR4
5AR40	120	Metal Oxide		5	906021	Electrosil TR5

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		CONSTANT-VOLTAGE AMPLIFIER (Cont'd)				
	Resistors (Cont'd)					
	ohm		W			
5AR41	100k	Metal Oxide		5	908293	Electrasil TR4
5AR42	68	Wirewound	2.5	5	913592	Welwyn W21
5AR43	100k	Metal Oxide		5	908293	Electrosil TR4
5AR44	47k	Metal Oxide		5	908391	Electrosil TR4
5AR45	1k	Metal Oxide		5	919805	Electrasil TR4
	Capacitors					
	F		V			
5AC1	0.1µ	Fixed		20	914173	ITT PMC2R/M100
5AC2	100µ	Fixed	20	10	913445	Kemet K100 J20KS
5AC3	.001µ	Fixed	20	500	915243	Erie 831
5AC4	.001µ	Fixed	20	500	915243	Erie 831
5AC5	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC6	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC7	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC8	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC9	.01µ	Fixed		+50 -25	911845	Erie 831T/25V
5AC10	68p	Fixed		10	917737	Erie 831/2200
5AC11	.01µ	Fixed		+50 -25	911845	Erie 831T/25V
5AC12	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC13	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC14	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC15	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC16	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC17	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC18	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC19	0.1µ	Fixed		20	914173	ITT PMC2R/0.1/M100
5AC20	100p	Fixed	500	10	917417	Erie 831 IN3300
5AC21	470p	Fixed	500	10	917453	Erie 831K170051
5AC22	0.1µ	Fixed		20	914973	ITT PMC2R/0.1/M100
	Inductors					
5AL1	10µH	Choke			922364	Cambian 550-3640-45-02
	Transformers					
5AT1					CT603711	
5AT2					CT603710	

Cct. Ref.	Value	Description	Rat	Tal %	Racal Part Number	Manufacturer
		CONSTANT-VOLTAGE AMPLIFIER (Cont'd)				
		Transistors				
5ATR1		BC107			911929	Mullard
5ATR2		BC107			911929	Mullard
5ATR3		BC107			911929	Mullard
5ATR4		BYC71			911928	Mullard
5ATR5		BFY51			908753	Mullard
5ATR6		BSX61			916632	Mullard
5ATR7		BSX61			916632	Mullard
5ATR8		BSX61			916632	Mullard
5ATR9		BC107			911929	Mullard
5ATR10		BSX61			916632	Mullard
5ATR11		BC107			911929	Mullard
5ATR12		BC107			911929	Mullard
5ATR13		BC107			911929	Mullard
5ATR14		BC107			911929	Mullard
5ATR15		BC107			911929	Mullard
5ATR16		BCY71			911928	Mullard
5ATR17		BCY71			911928	Mullard
		Diodes				
5AD1		BZY88C5V6			912747	Mullard
5AD2		IN4149			914898	Mullard
5AD3		BZY88C12			914310	Mullard
5AD4		NOT USED				
5AD5		IN4149			914898	Mullard
5AD6		IN4149			914898	Mullard
5AD7		IN4149			914898	Mullard
5AD8		BZY88C6V8			914064	Mullard
5AD10		IN4149			914898	Mullard
5AD11		IN4149			914898	Mullard
5AD12		IN4149			914898	Mullard
5AD13		BZY88C6V8			914064	Mullard
5AD14		BZY88C12			914310	Mullard
5AD15		IN4149			914898	Mullard
5AD16		IN4149			914898	Mullard
5AD17		BZY88C12			914310	Mullard
5AD18		IN4149			914898	Mullard
5AD19		IN4002			911460	ITT
5AD20		IN4149			914898	Mullard
5AD21		IN4149			914898	Mullard

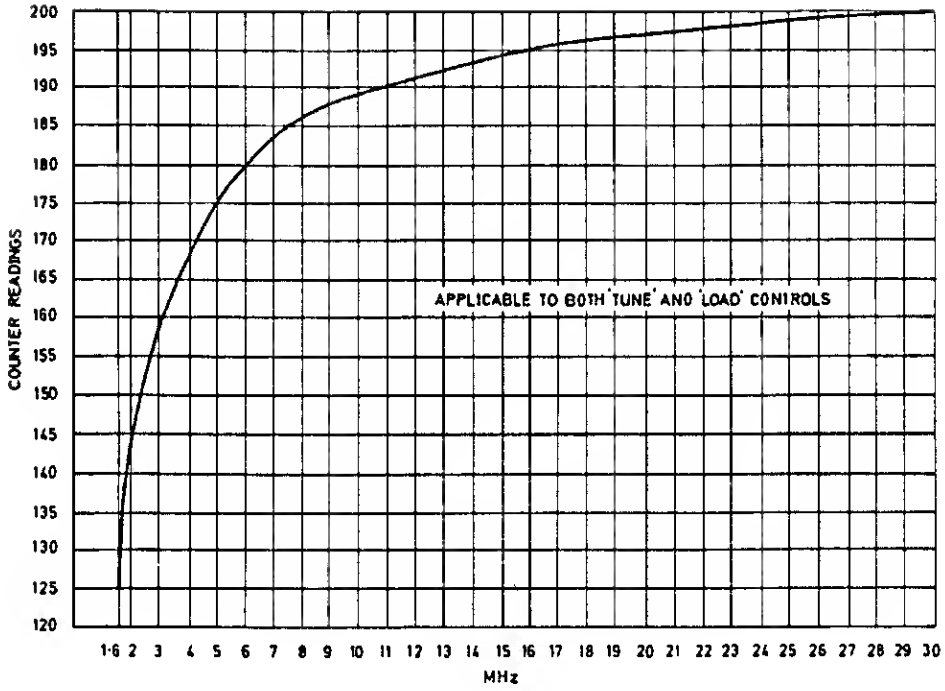
Cct. Ref.	Value	Description	Rat	Tal %	Racal Part Number	Manufacturer
		CONSTANT-VOLTAGE AMPLIFIER (Cont'd)				
	Relays					
5ARLA					921505	Leach ER2-2A-A1A
	Plugs					
5PL1		Coaxial			917970	Transradio BN14/5
5PL2					909729	Cannan DA15P
5PL3					916489	Cannan DB25P
	Sockets					
5SK1		Coaxial			900061	Transradio BN12/5
	Miscellaneaus					
5AFB1		Ferrite bead			907488	Mullard FX1242
5AFB2		Ferrite bead			907488	Mullard FX1242
5AFB3		Ferrite bead			907488	Mullard FX1242
5AFB4		Ferrite bead			907488	Mullard FX1242

Cct. Ref.	Value	Description	Rat	Tal %	Racal Part Number	Manufacturer
	'TUNE' COIL, MOTOR AND GEARBOX ASSEMBLY (MS451) CC603155/A					
	LOAD COIL, MOTOR AND GEARBOX ASSEMBLY (MS451) CC603155/B					
	NOTE: The 'Tune' and 'Load' Assemblies are identical except for the Contacts for IL1 and IL2.					
	Resistors					
	ohm		W			
6R1	56	Metal Oxide		5	908289	Electrosil TR4
6R2	10	Metal Oxide		5	912868	Electrosil TR4
6R3	220	Metal Oxide	7	10	923147	Electrosil FP7
	Capacitors					
	F					
6C1	0.1µ	Fixed			914973	PMC 2R0.1/M100
6C2	395p	Variable			AD603233	
6C3	1000p	Fixed		10	915243	Erie H1-K831/K2600
	Diodes					
6D1		BYX38300			910957	
6D2		BYX38300			910957	
6D3		BYX38300			910957	
6D4		BYX38300			910957	
	Switches					
6SA		Micro			907169	Burgess M1
6SB		Micro			907169	Burgess M1
	Motor					
6ME1		28V			919929	Vactric 18P409
	Terminal Strip					
6TB1					901605	Carr 44/77/508/8M
	Miscellaneous					
		Contact for IL1			CD603603	
		Contact for IL2			CD603604	

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part N8mber	Manufacturer
		COARSE-TUNE DISCRIMINATOR (PS106) BC600506				
	Resistors					
	ohm		W			
6AR1	560	Metal Oxide		5	909841	Electrasil TR4
6AR2	470	Metal Oxide		5	900992	Electrasil TR4
6AR3	560	Metal Oxide		5	909841	Electrasil TR4
6AR4	1k	Metal Oxide		5	908267	Electrasil TR4
6AR5	1k	Metal Oxide		5	908267	Electrasil TR4
6AR6	47k	Metal Oxide		5	908391	Electrasil TR4
6AR7	220	Variable		20	916289	Plessey Type GMK 5A
	Capacitors					
	F		V			
6AC1	4-60pμ	Variable	375		916940	Mullard 908-07011
6AC2	0.01μ	Ceramic Disc	100	-20+80	900067	Erie CD801/K800011
6AC3	220pμ	Silver Mica	350	2	902242	Lemco MS119/1/R
6AC4	0.01μ	Ceramic Disc	100	-20+80	900067	Erie CD801/K800011
6AC5	0.01μ	Ceramic Disc	100	-20+80	900067	Erie CD801/K800011
6AC6	0.01μ	Ceramic Disc	100	-20+80	900067	Erie CD801/K800011
6AC7	1000pμ	Ceramic	350	20	902122	Erie K350081AD/PL107
	Transformers					
6AT1		Coil Assembly			CT600833/B	
	Diodes					
6AD1		Silican			906673	Mullard 1N 916
6AD2		Silicon			906673	Mullard 1N 916
6AD3		Silican			906673	Mullard 1N 916
6AD4		Silican			906673	Mullard 1N 916

Cct. Ref.	Value	Description	Rat	Tal %	Racal Part Number	Manufacturer
		SWITCHBANK ASSEMBLY CA603351				
	Capacitors					
	F		V			
7C1	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
7C2	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
7C3	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
7C4	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
7C5	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
7C6	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
7C7	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
7C8	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
7C9	0.1u	Fixed		20	914173	ITT PMC2R/0.1/M100
	Switches					
7SA		Microswitch			919551	Burgess V4T7YR1
7SB		Micraswitch			919551	Burgess V4T7YR1
7SC		Microswitch			919551	Burgess V4T7YR1
7SD		Micraswitch			919551	Burgess V4T7YR1
7SE		Micraswitch			919551	Burgess V4T7YR1
7SF		Micraswitch			919551	Burgess V4T7YR1
7SG		Micraswitch			919551	Burgess V4T7YR1
	Terminal Strip					
7TB1		12-way			922181	Klippon MKL2/12 2413

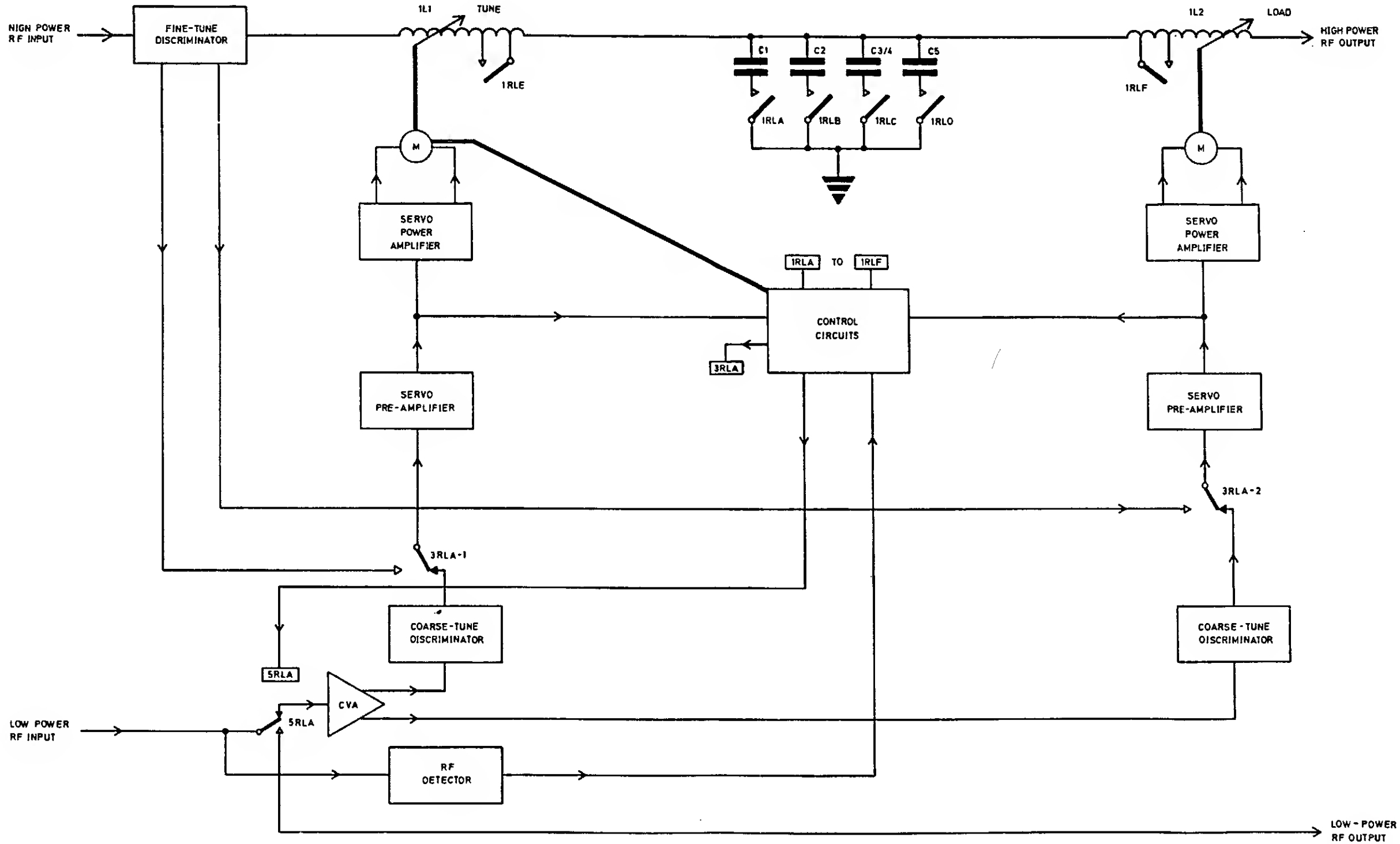
Cct. Ref.	Value	Description	Rat	Tol %	Racal Part Number	Manufacturer
		SERVO POWER AMPLIFIER (MS265)CC600191				
	Resistors					
	ohm		W			
9R1	1	Wirewound	12	5	918486	Welwyn W24
9R2	4.7k	Metal Oxide		5	911002	Electrosil TR5
9R3	1.5k	Metal Oxide		5	906027	Electrosil TR5
9R4	680	Metal Oxide		5	908390	Electrosil TR4
9R5	680	Metal Oxide		5	908390	Electrasil TR4
	Capacitors					
	F		V			
9C1	0.1µ	Polyester	250	10	915918	Mullard 344-41103
9C2	0.1µ	Polycarbonate	100	20	914173	ITT PMC2R/0.1/M100
9C3	0.1µ	Polycarbonate	100	20	914173	ITT PMC2R/0.1/M100
9C4	0.1µ	Disc Ceramic	30		906675	Erie 811/T/30V
	Transistors					
9TR1		Silicon n-p-n			917389	Mullard BSW66
9TR2		Silicon n-p-n, Power			917289	Westinghouse 2N 3233
9TR3		Silicon p-n-p, Power			917390	Motorola 2N 3635
9TR4		Silicon n-p-n, Power			917289	Westinghouse 2N 3233
	Diodes					
9D1		Silicon			900651	Mullard 1N 914
9D2		Zener: 1.3V	400mW	5	915493	Mullard BZY 88 C1V3
9D3		Zener: 1.3V	400mW	5	915493	Mullard BZY 88 C1V3
9D4		Silicon			900651	Mullard 1N 914
9D5		Zener: 1.3V	400mW	5	915493	Mullard BZY 88 C1V3
9D6		Zener: 1.3V	400mW	5	915493	Mullard BZY 88 C1V3
	Connectors					
9PL1		15-way Plug			909729	Cannon DA 15P
9TR1		6-way Terminol Block			915495	Wingrave & Rogers TS6-06



WOH3043

Manual Coarse-Tuning Graph MA.1004

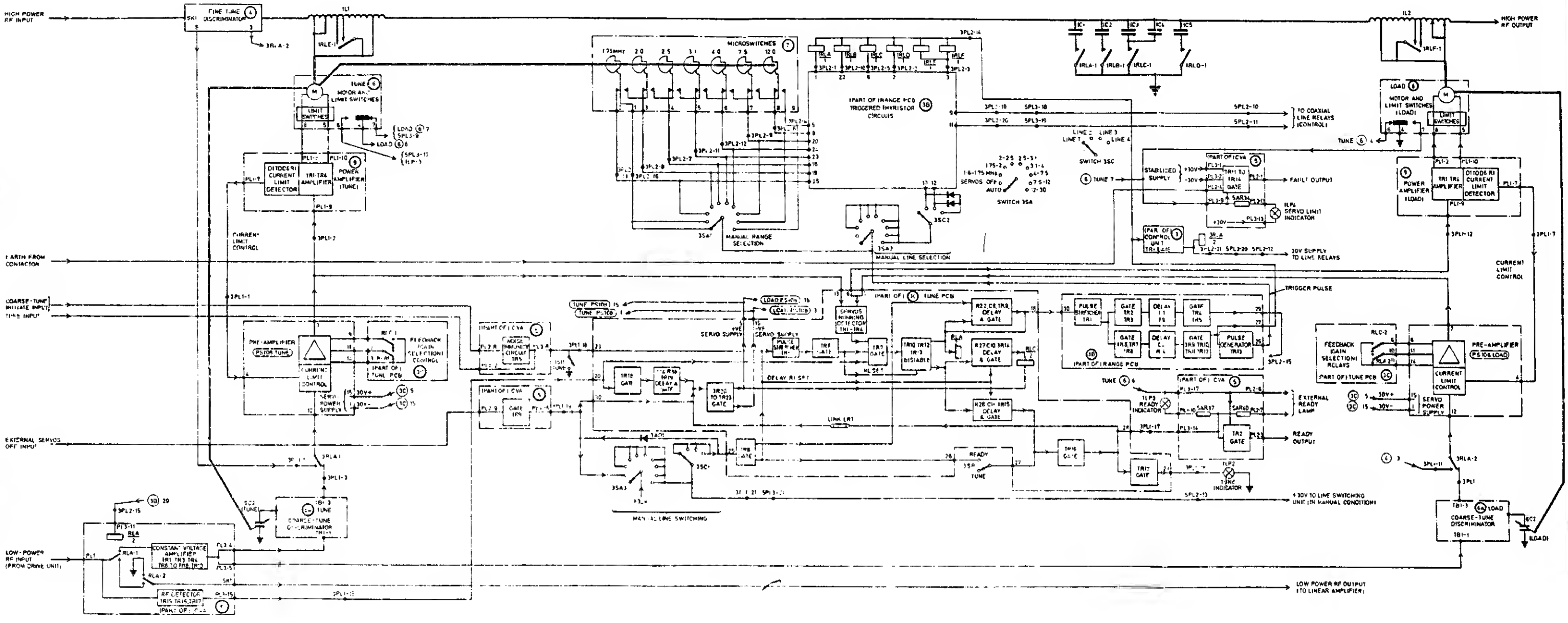
Fig.1



WOH3043

Simplified Block Diagram MA1004

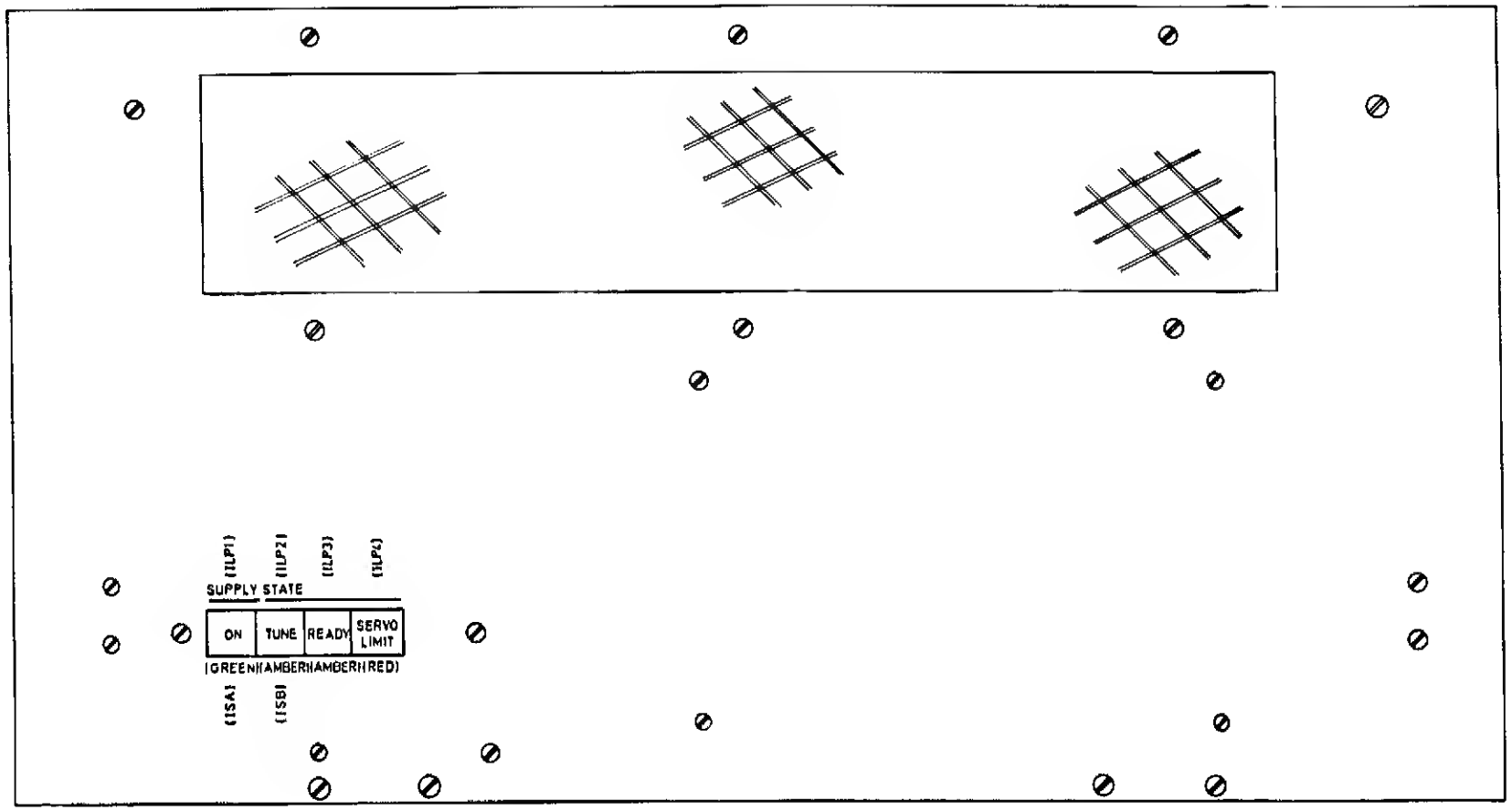
Fig.2

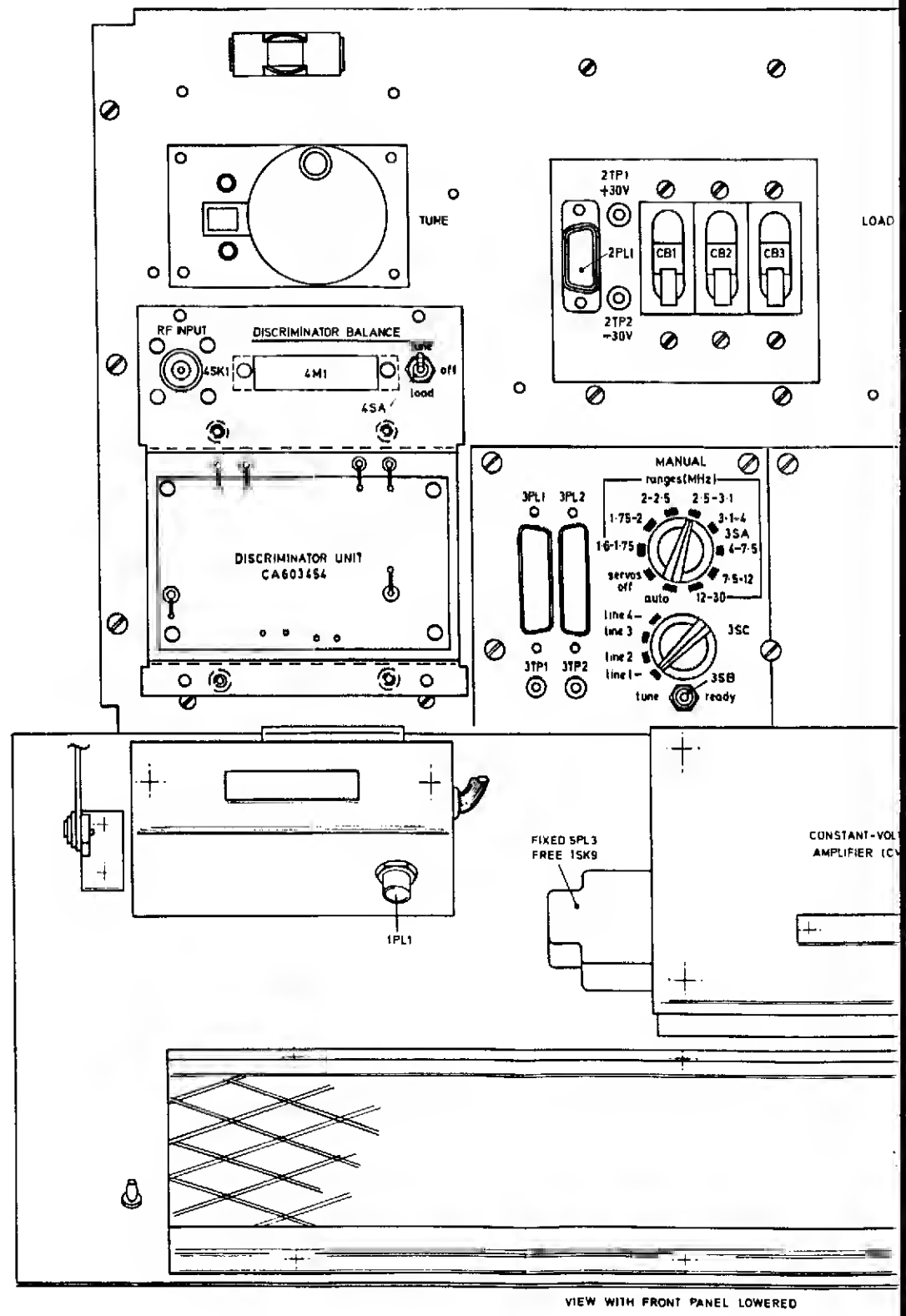


WOH 3743

Functional Diagram: MA1004 FMU

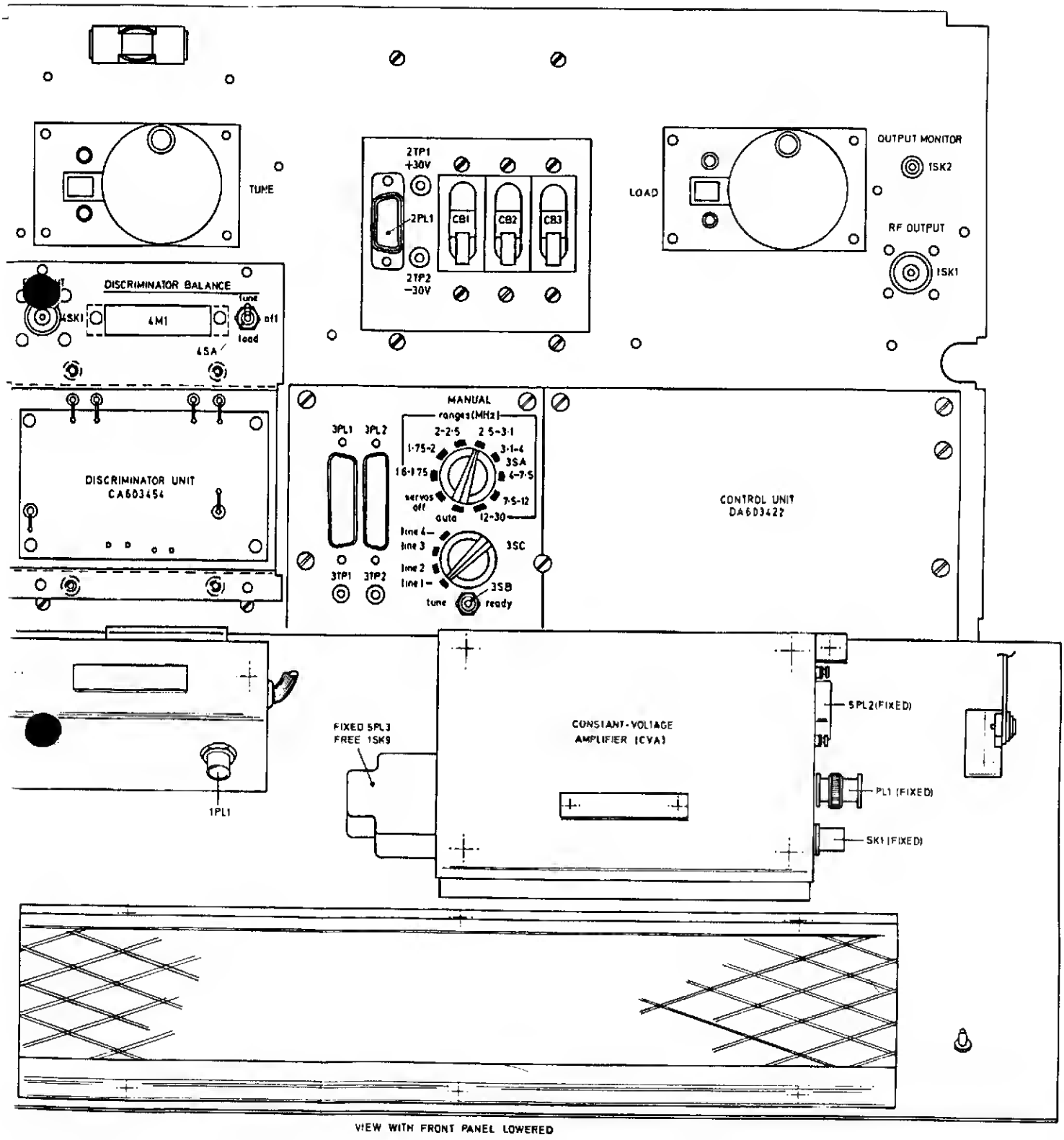
Fig. 3





VIEW WITH FRONT PANEL LOWERED

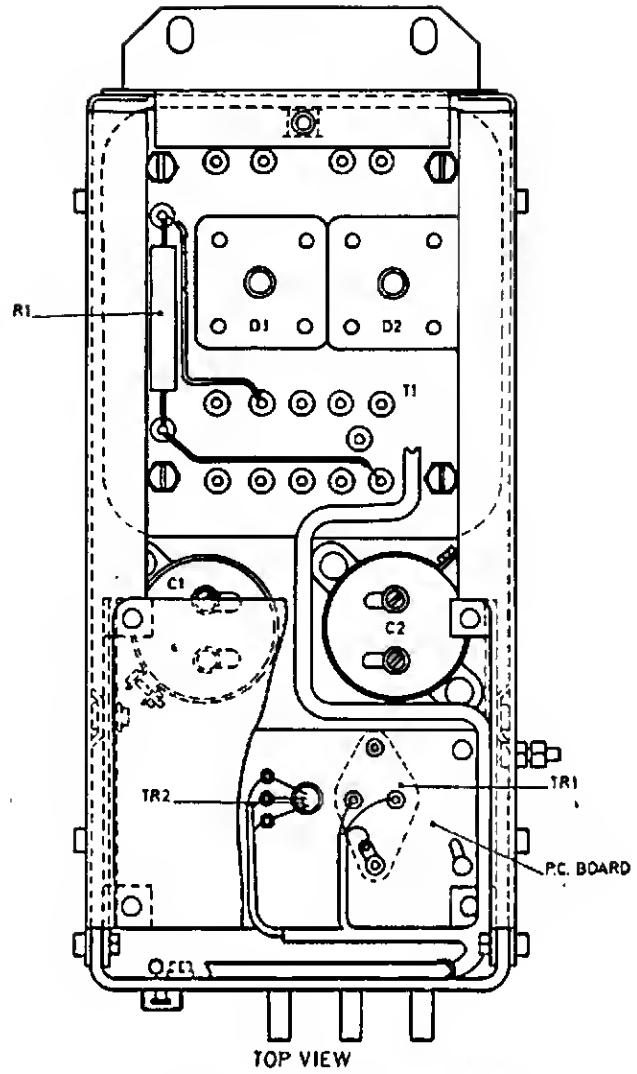
Layout: Front and Sub-front Panels MA.1004

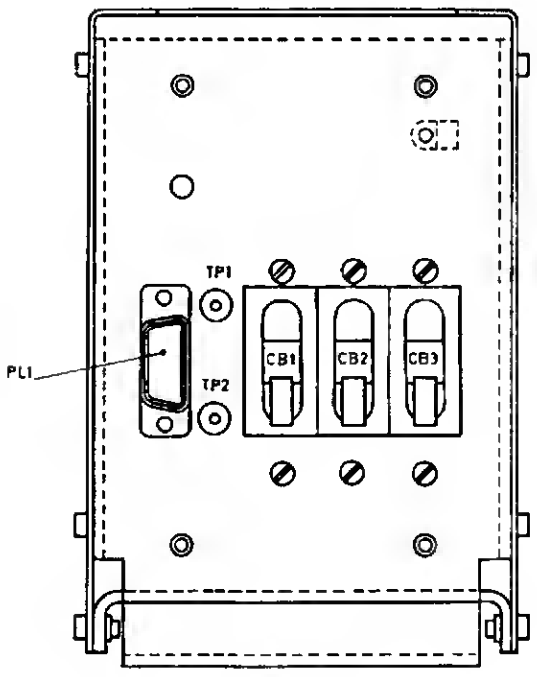


VIEW WITH FRONT PANEL LOWERED

A.1004

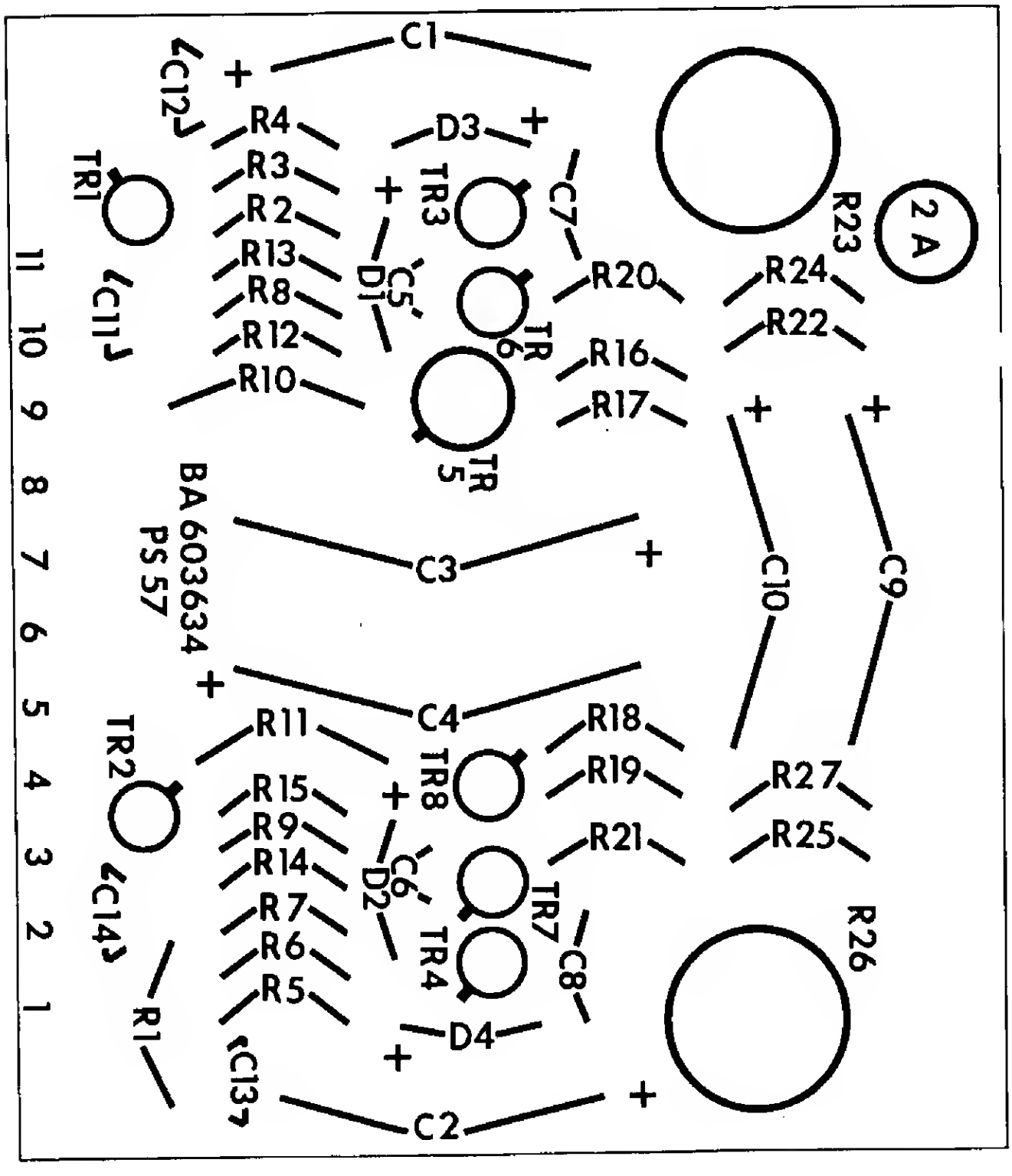
Fig.4





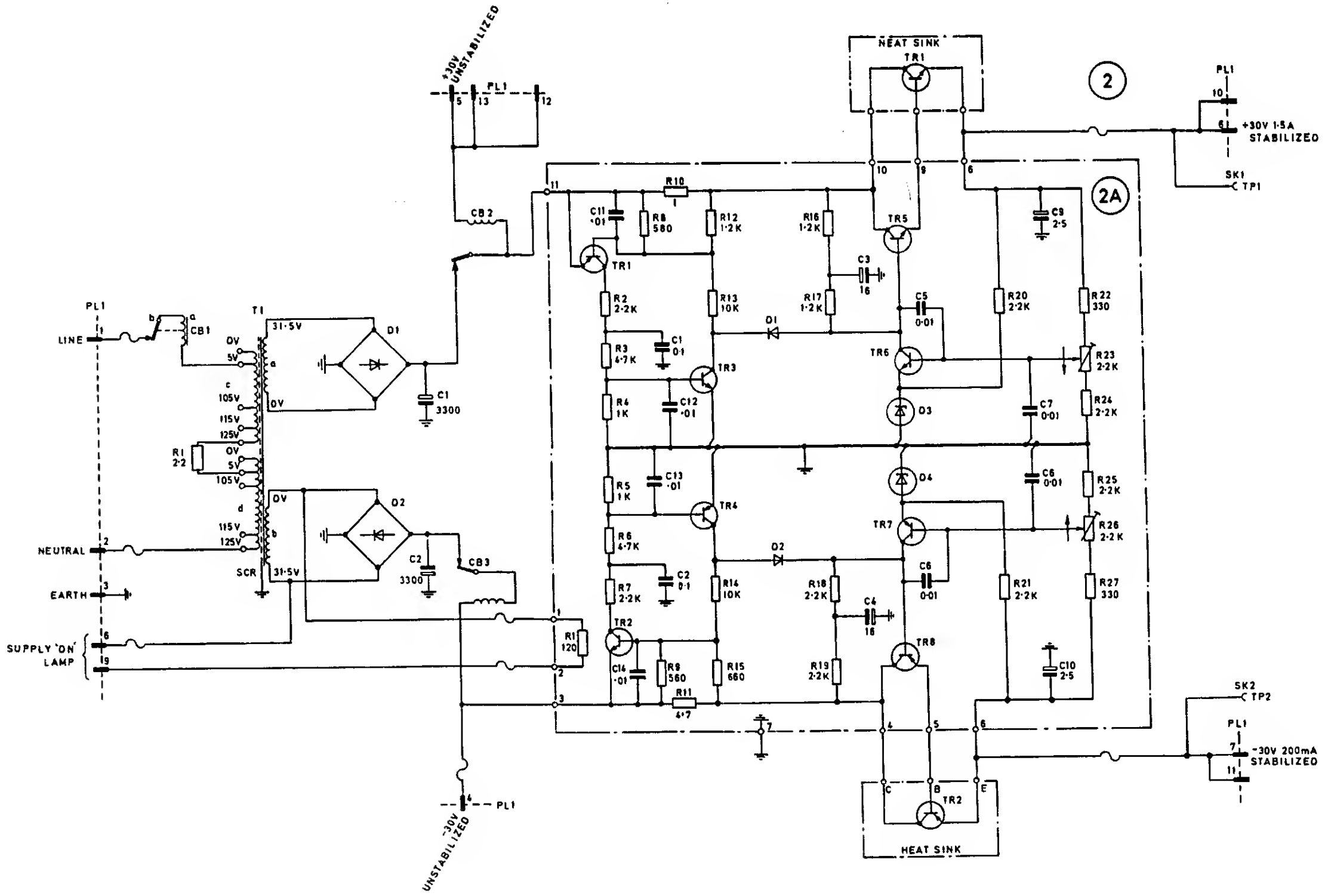
WOH 3043

Layout : Power Supply Unit (MS448) **Fig.5**



Layout:
Power Supply Unit PC Board (PS57)

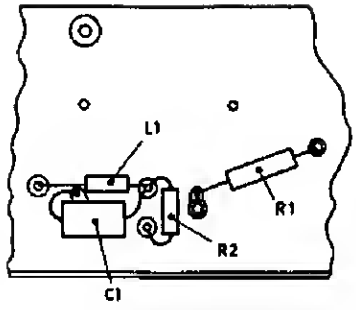
Fig. 6



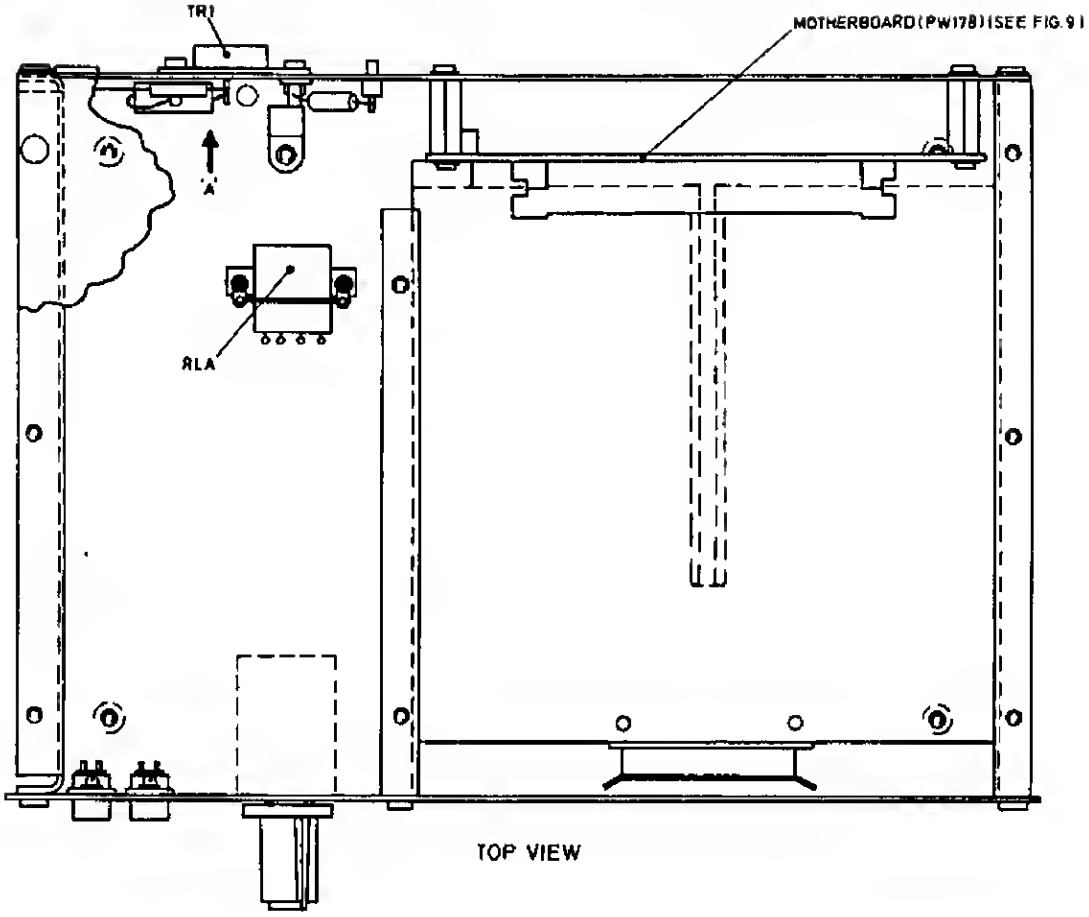
WON 3043	OC603514	
ISSUE	K	1

Circuit : Power Supply Unit (MS448 & PS57)

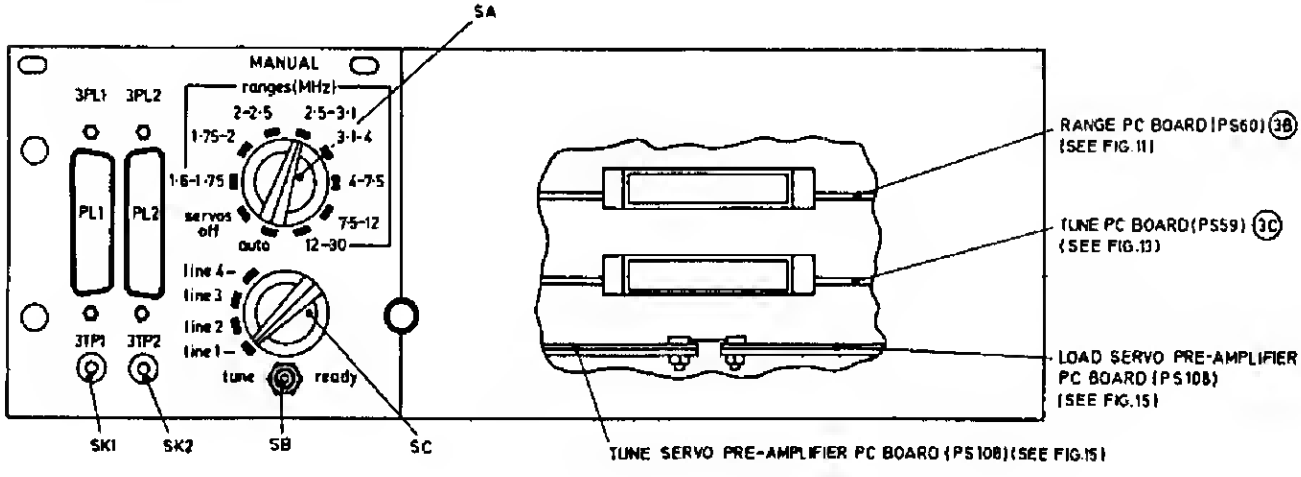
Fig. 7



SCRAP VIEW IN DIRECTION OF ARROW 'A'



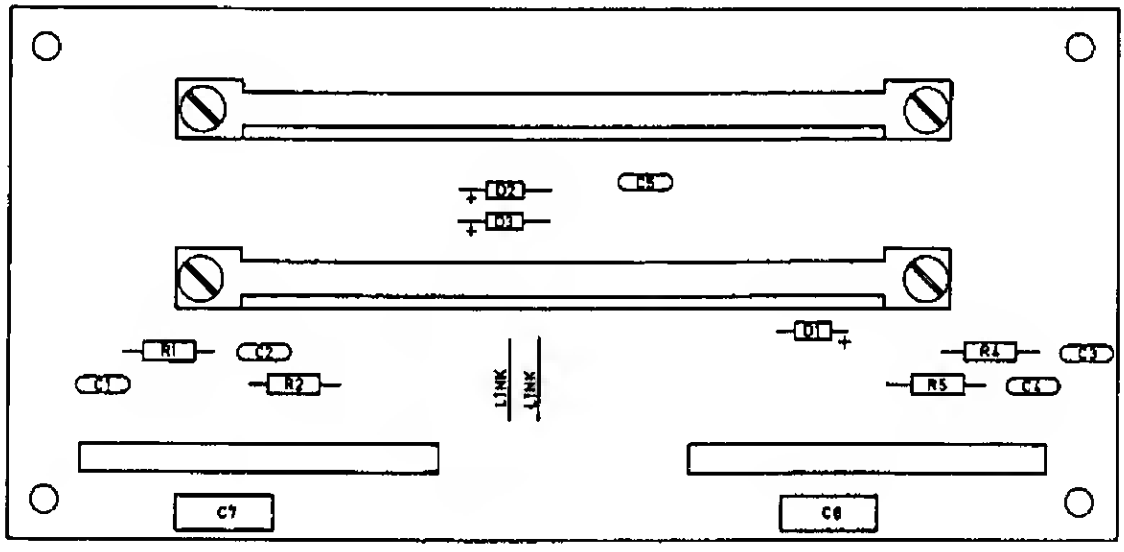
TOP VIEW



FRONT VIEW

Layout : Control Unit

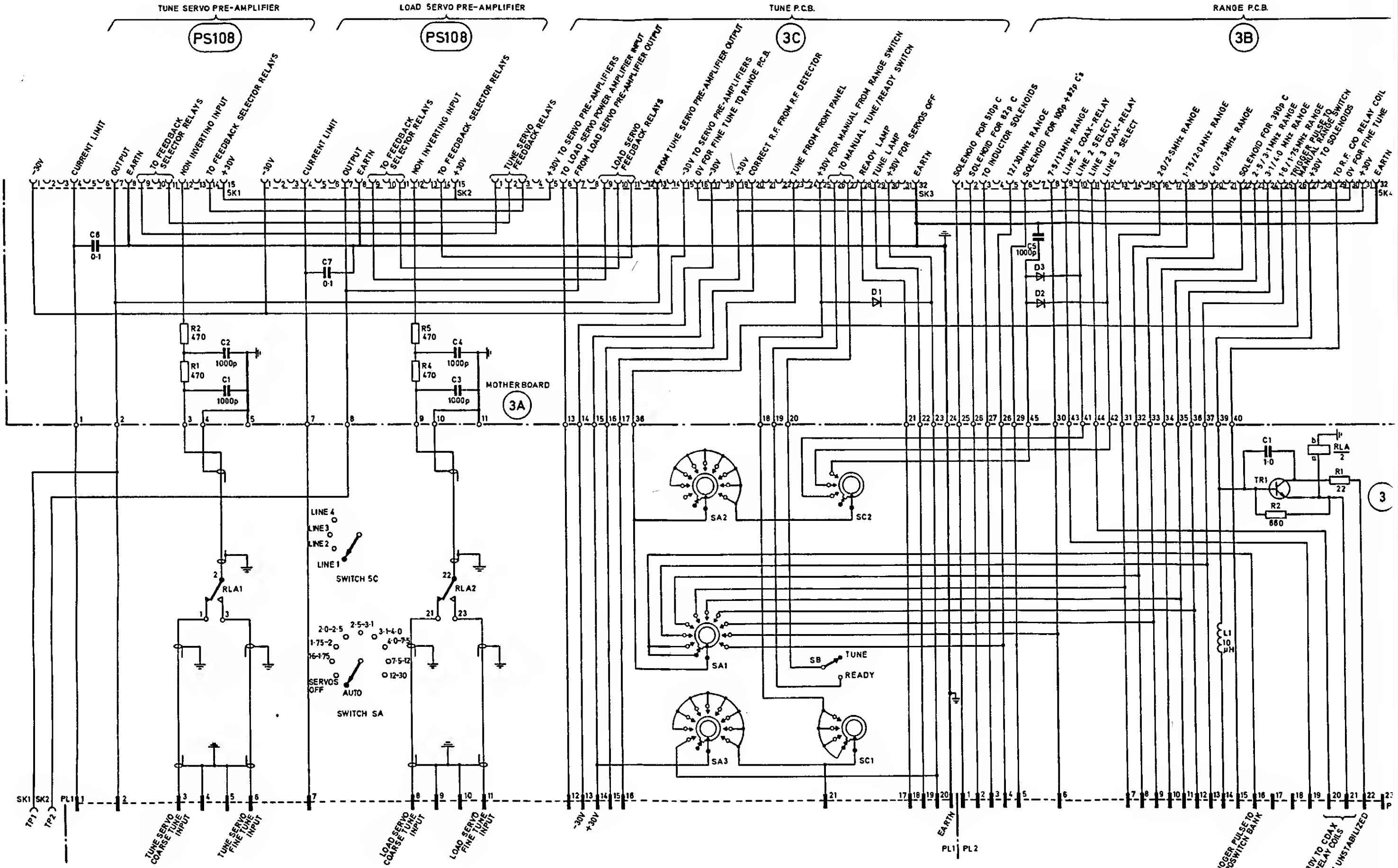
Fig.8



WOH3043

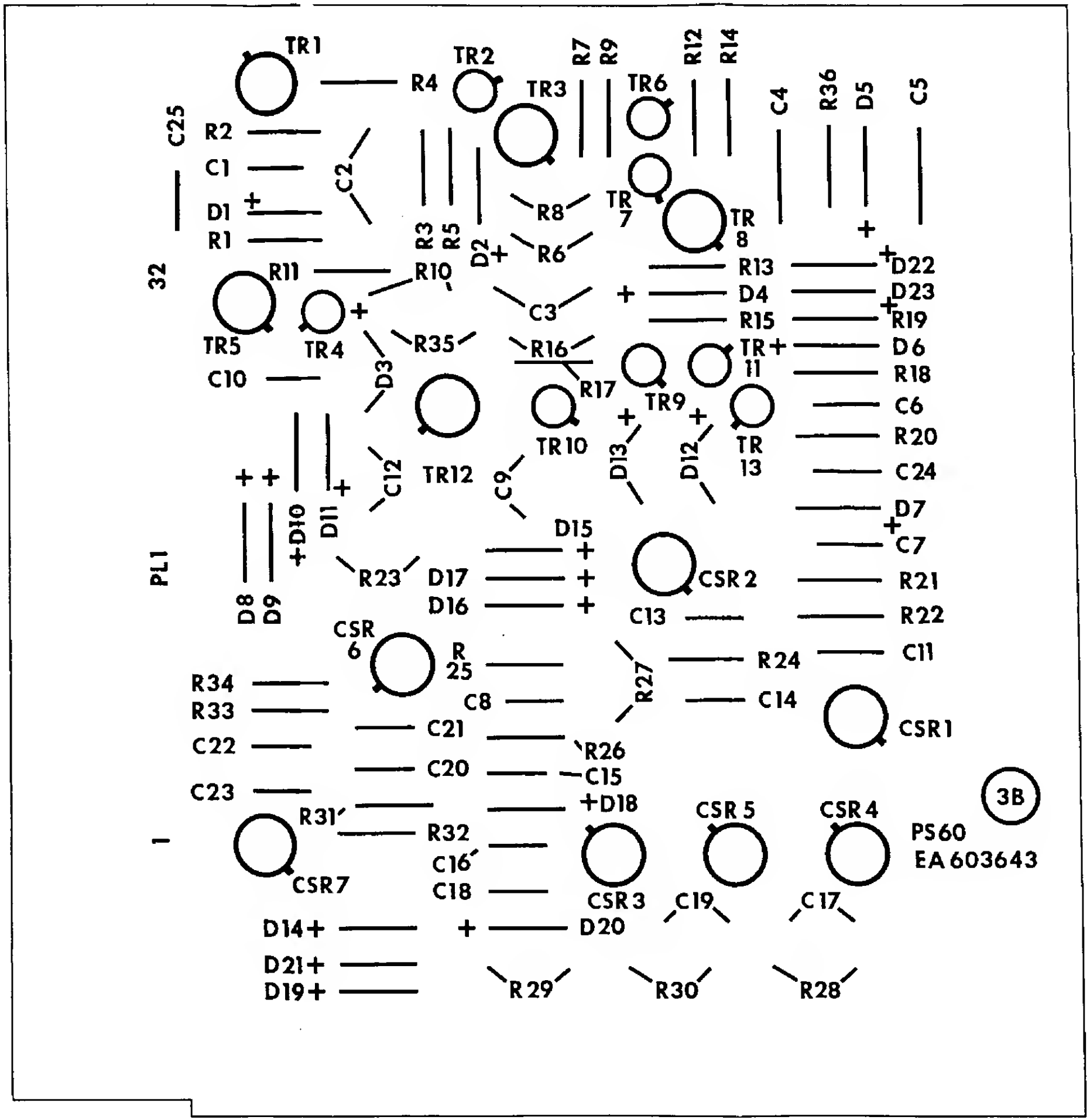
Layout : Motherboard (PW178)

Fig. 9



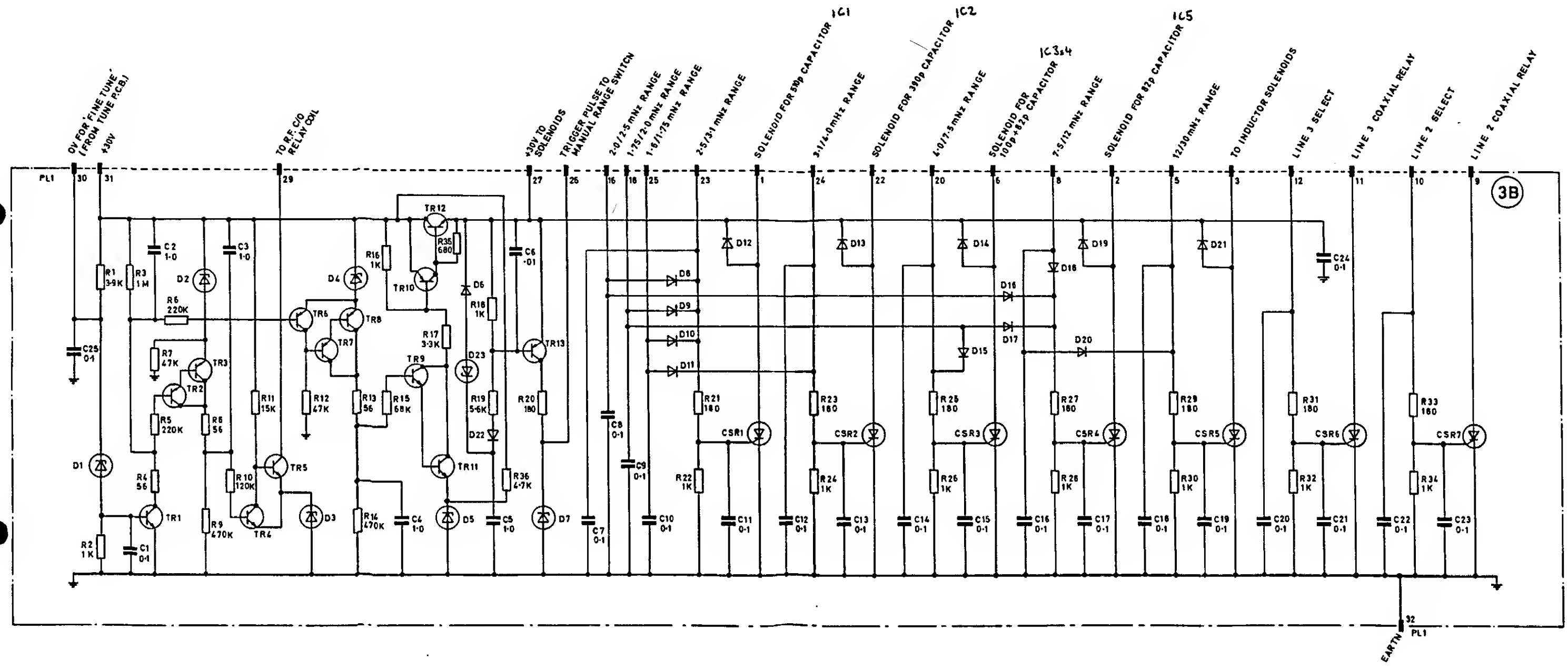
WOH 3043	DC603422
ISSUE C 1	

Circuit : Control Unit (MS450)



Layout: Range PC Board (PS60)

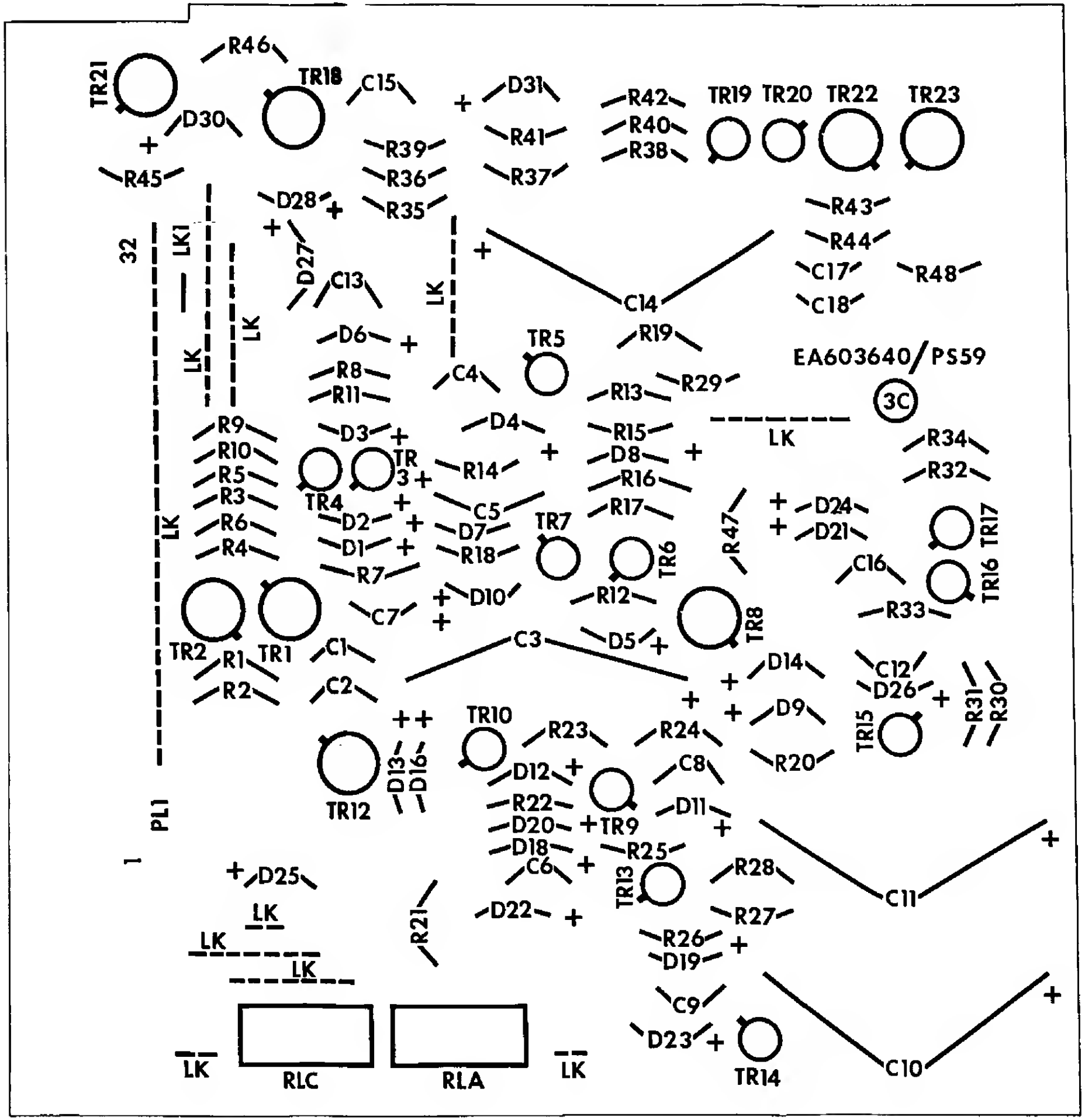
Fig. 11



WDH 3043	DC603643
ISSUE	G 1

Circuit : Range P.C. Board (PS60)

Fig.12

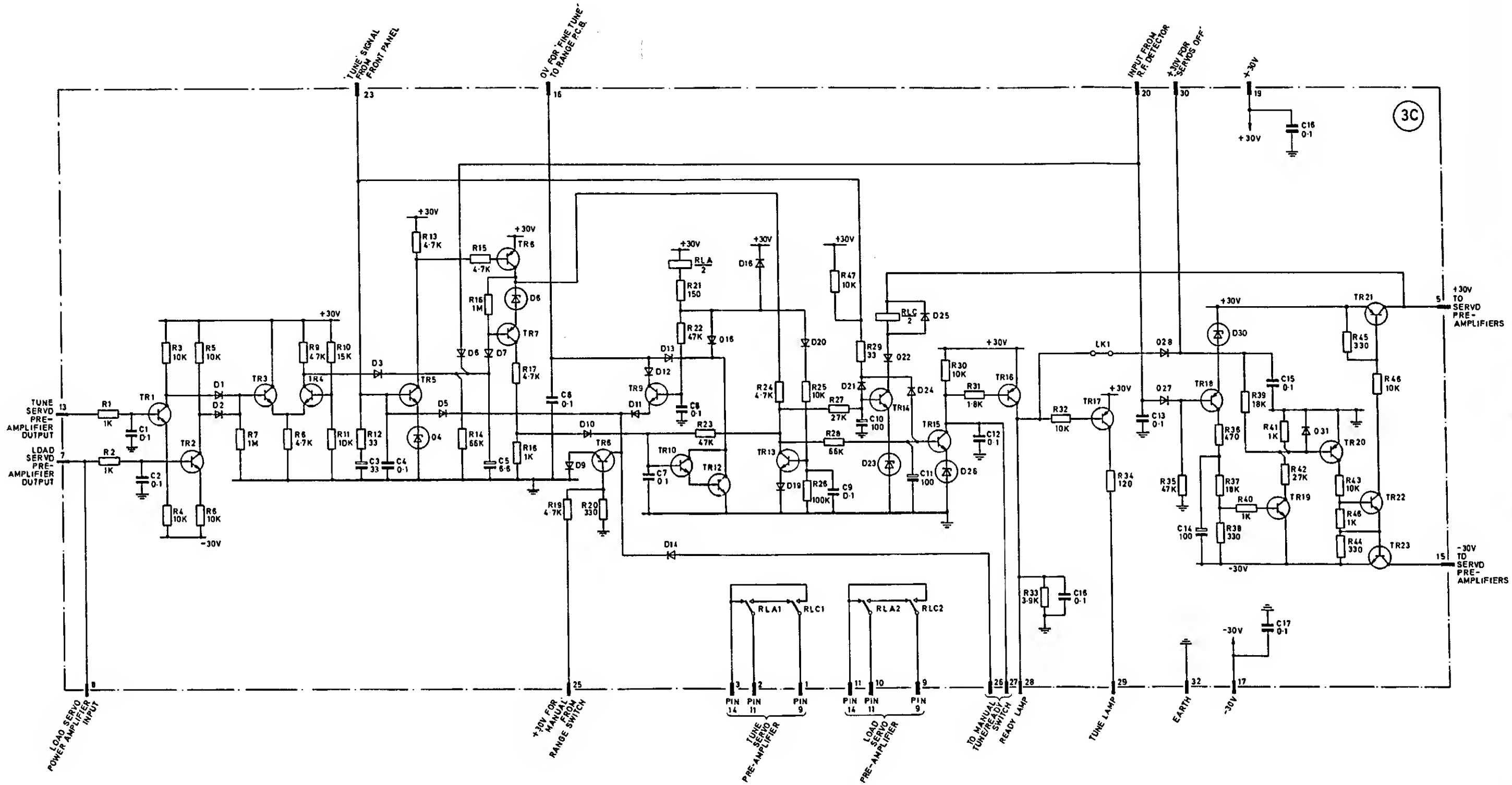


3C

WOH 3043 | E0603642
F1

Layout: Tune PC Board (PS59)

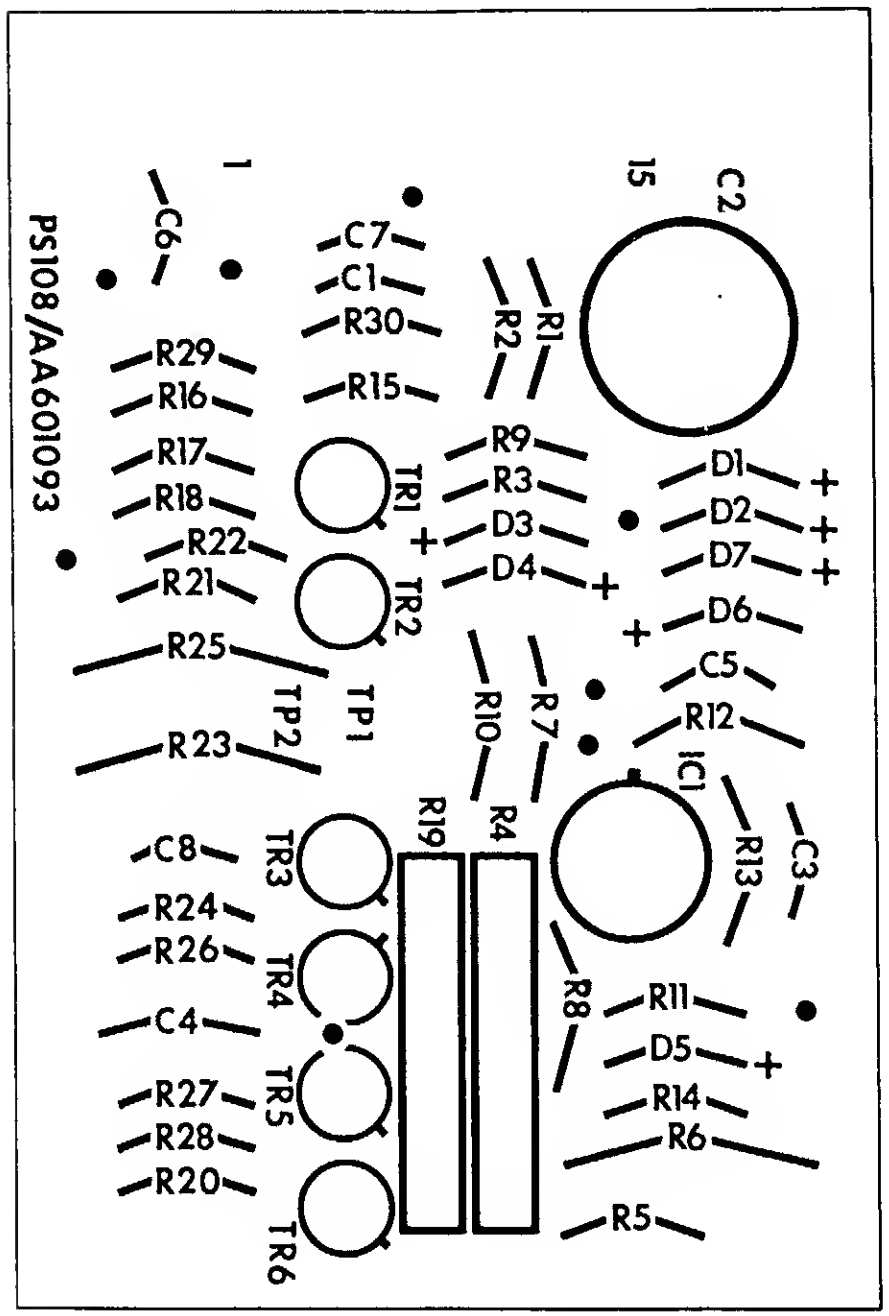
Fig. 13

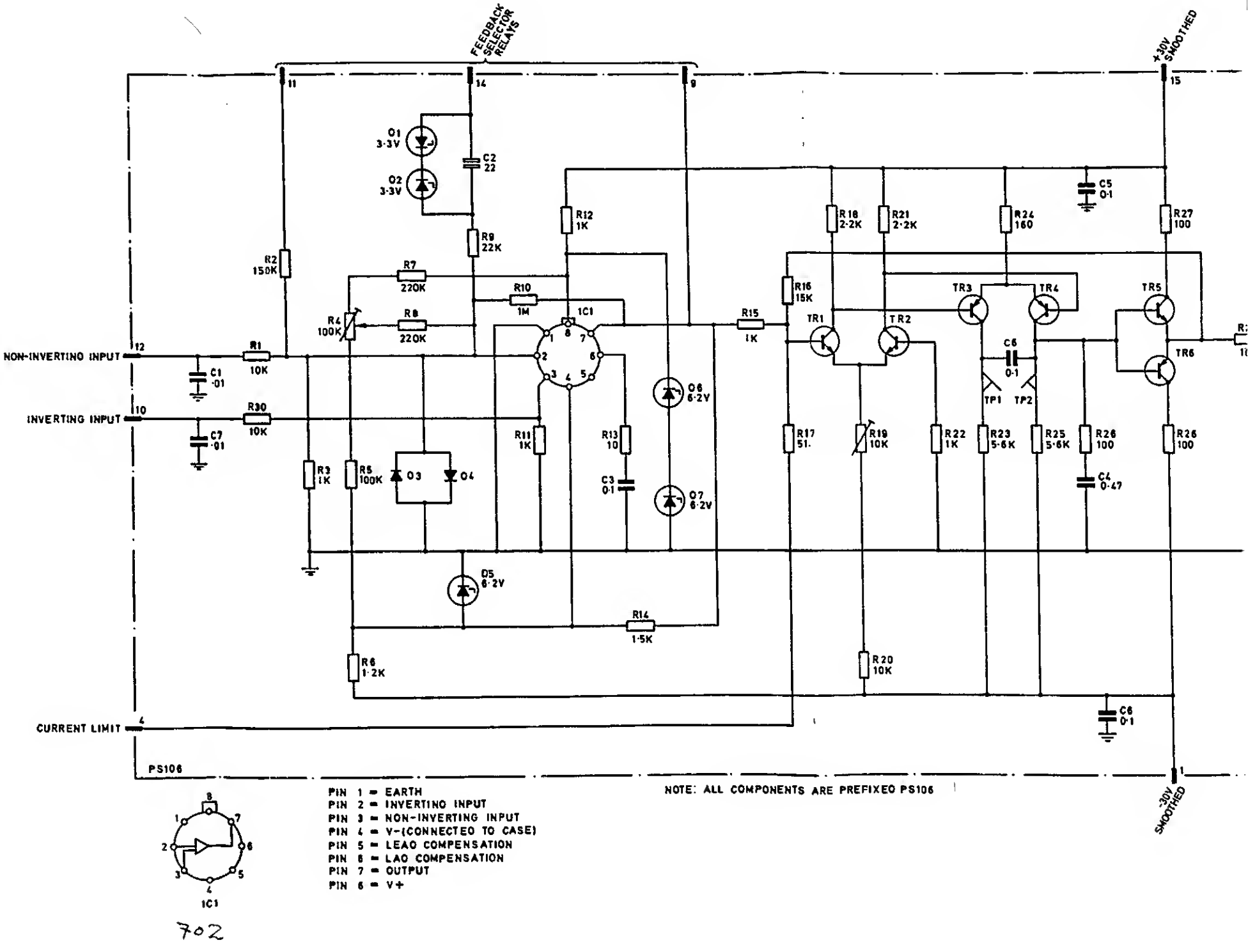


WDH 3043	DC603640
ISSUE F 1 2 3 4	

Circuit : Tune P.C. Board (PS 59)

Fig.14





702

PC42255 SHT.3
1

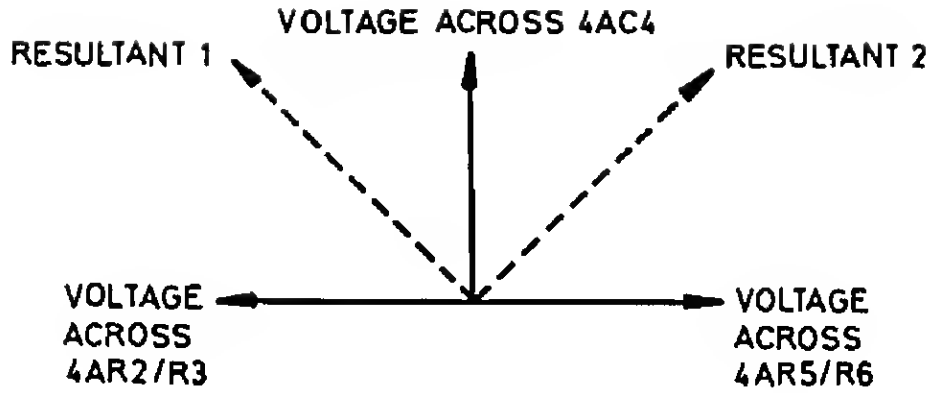
LAYOUT

CC601093
1

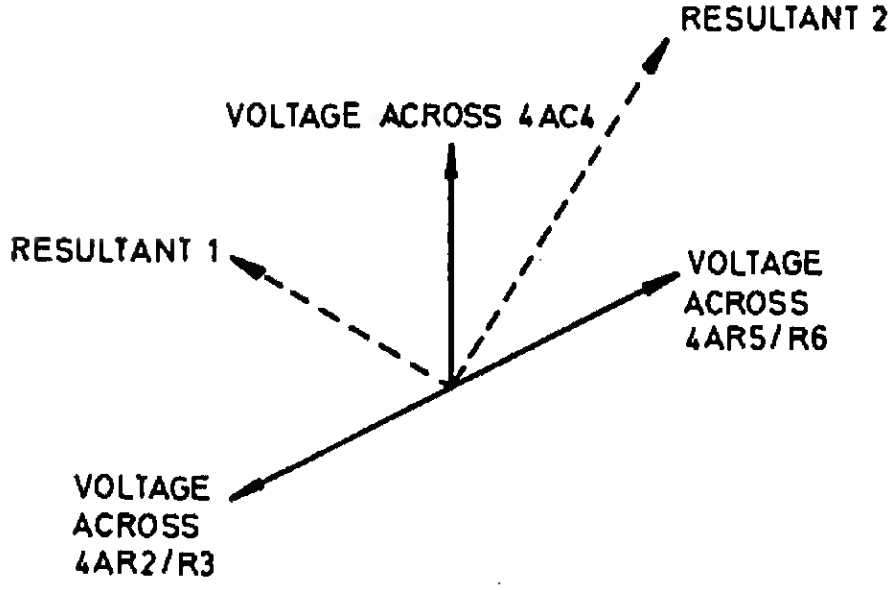
CIRCUIT

WOH 3069

Circuit and Layout: Servo Pre-Amplifier PC Board (PS108)



(A) INPUT IMPEDANCE RESISTIVE

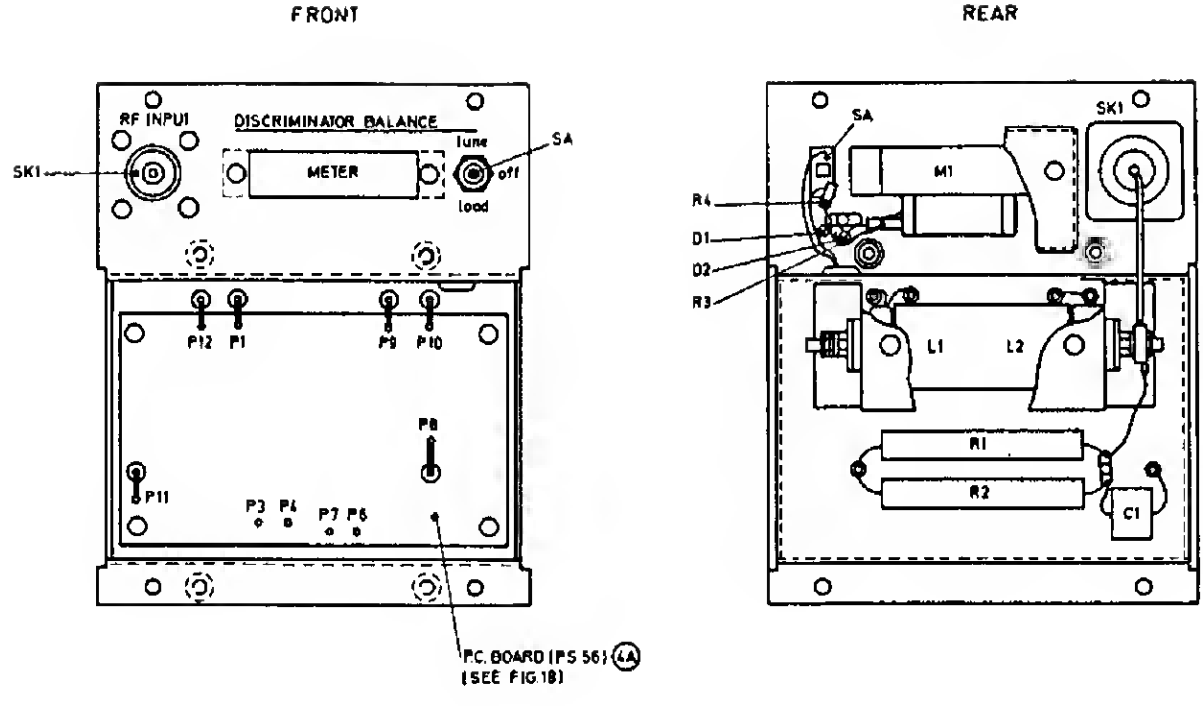


(B) INPUT IMPEDANCE REACTIVE

WOH3043

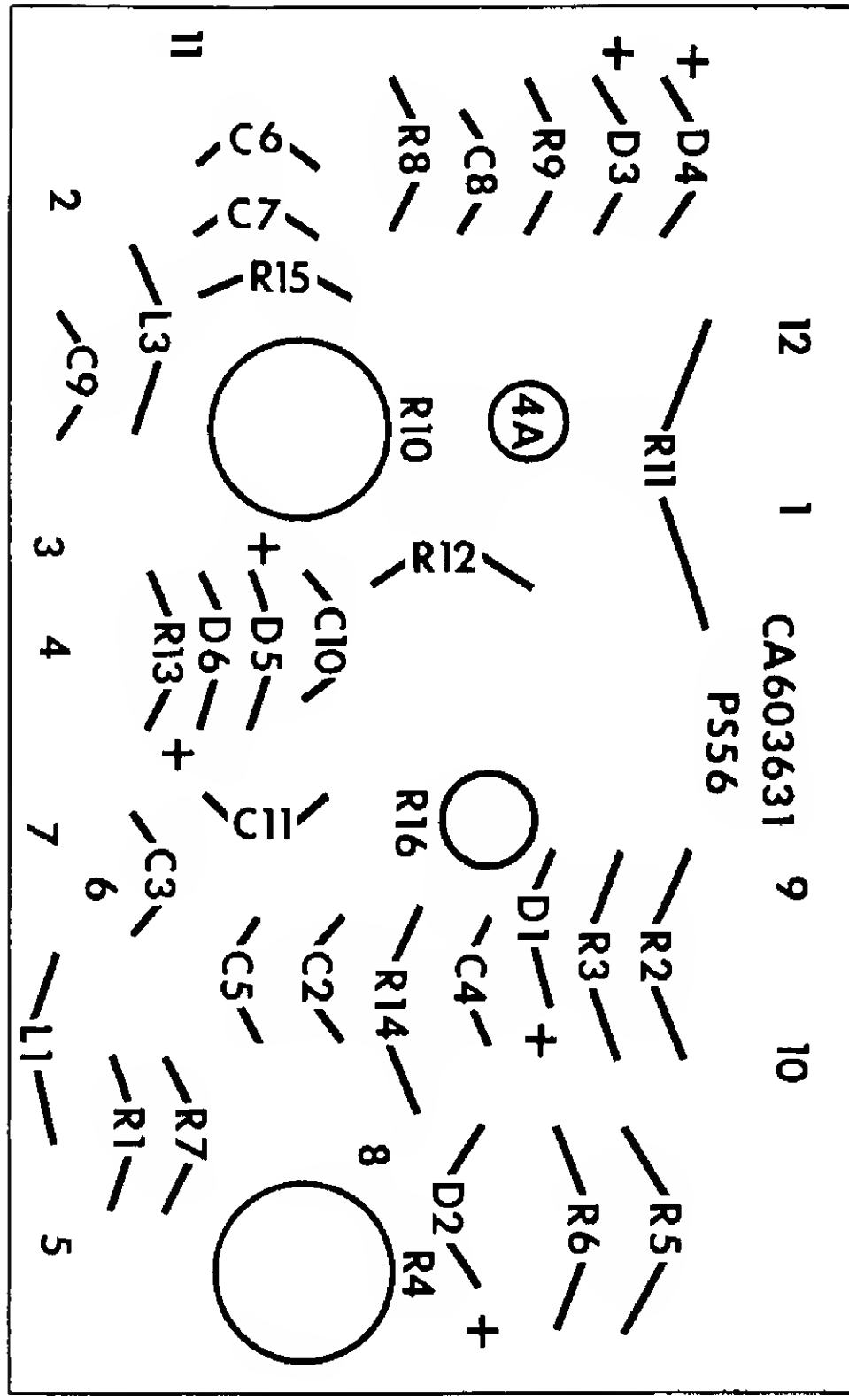
Phase Discriminator
Vector Diagrams: MA.1004

Fig. 16



WOH 3043

Layout: Fine-Tune Discriminator (MS 449) Fig.17

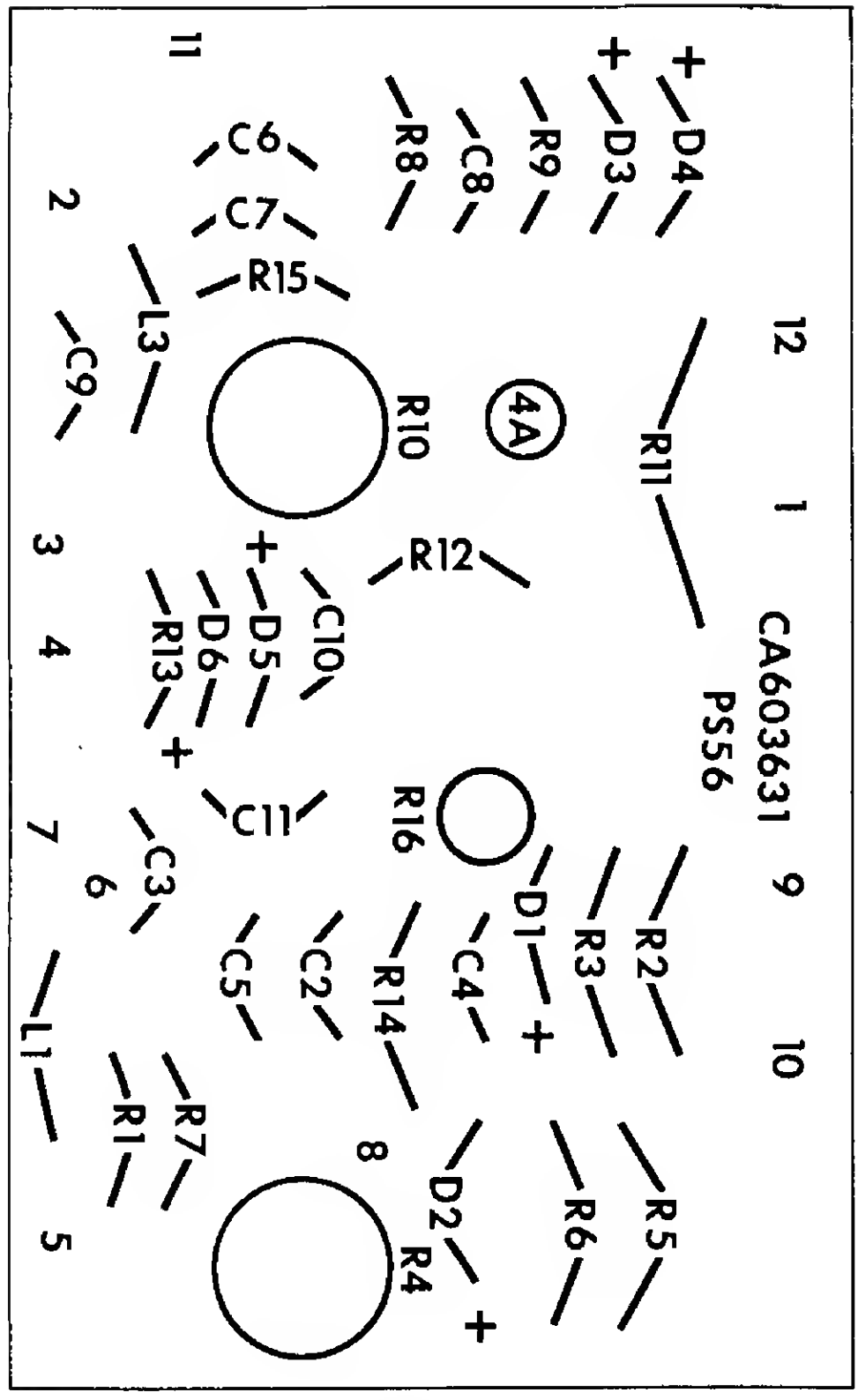


4A

WOH 3043 | DD603633
E

Layout: Fine-Tune Discriminator
PC Board (PS56)

Fig.18

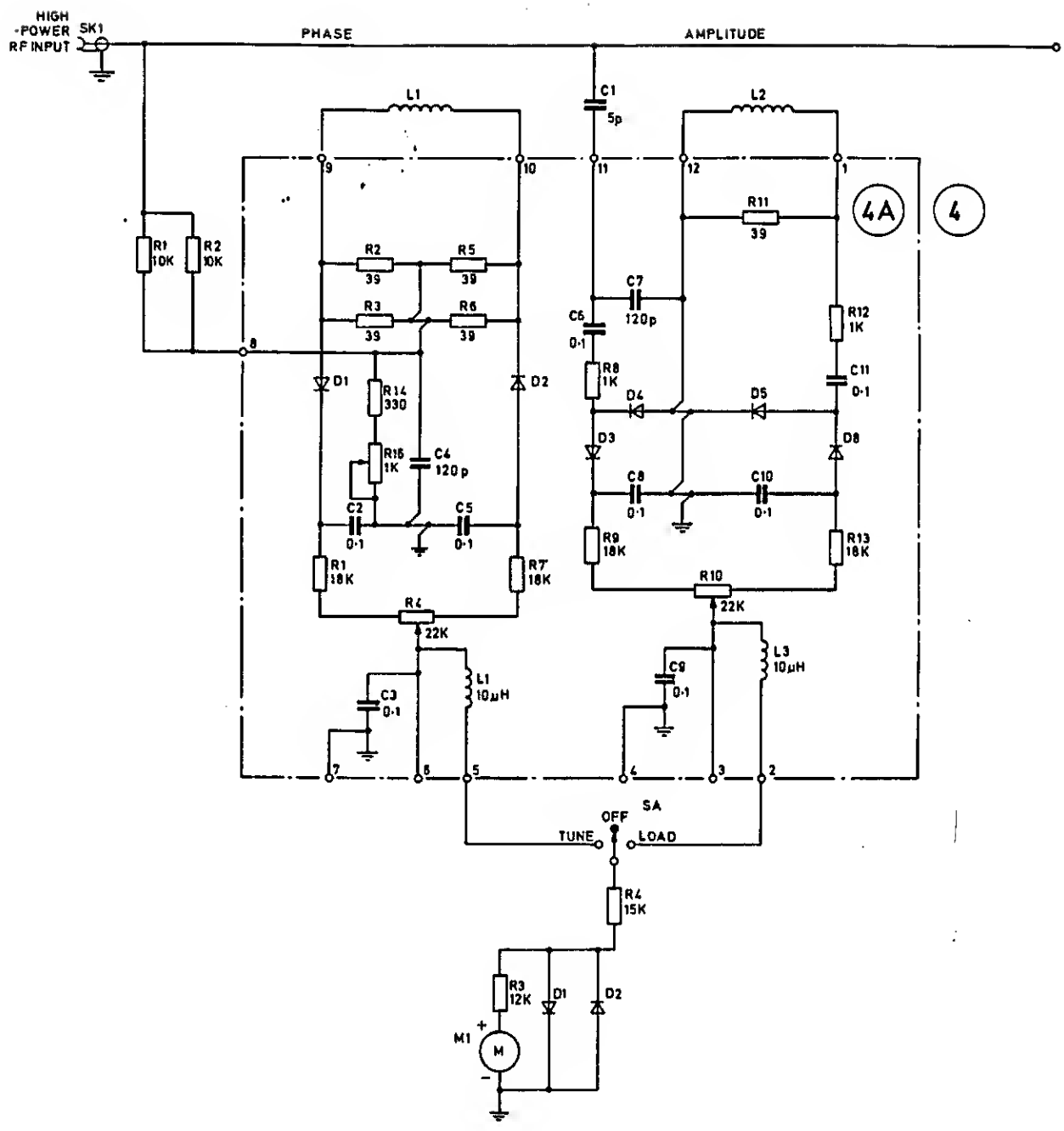


(4A)

WOH 3043 | D0603633
E

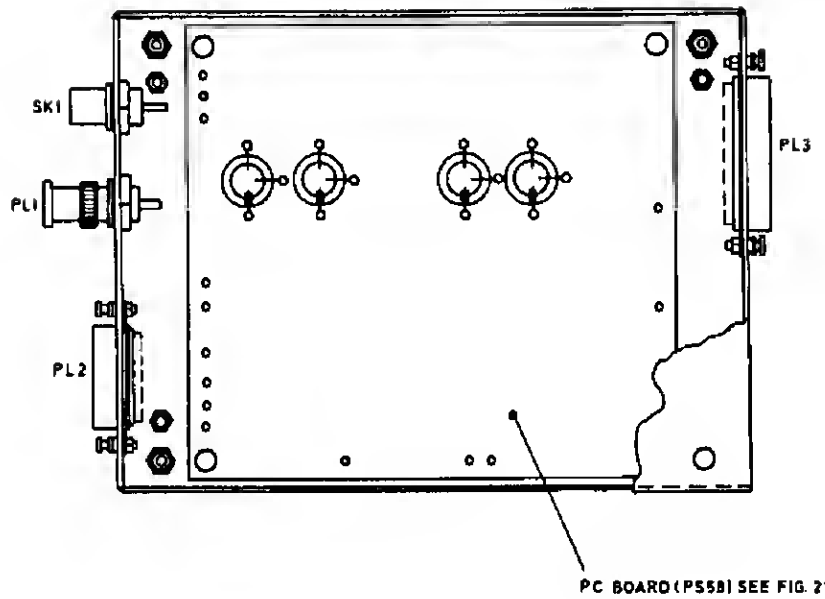
Layout: Fine-Tune Discriminator
PC Board (PS56)

Fig.18

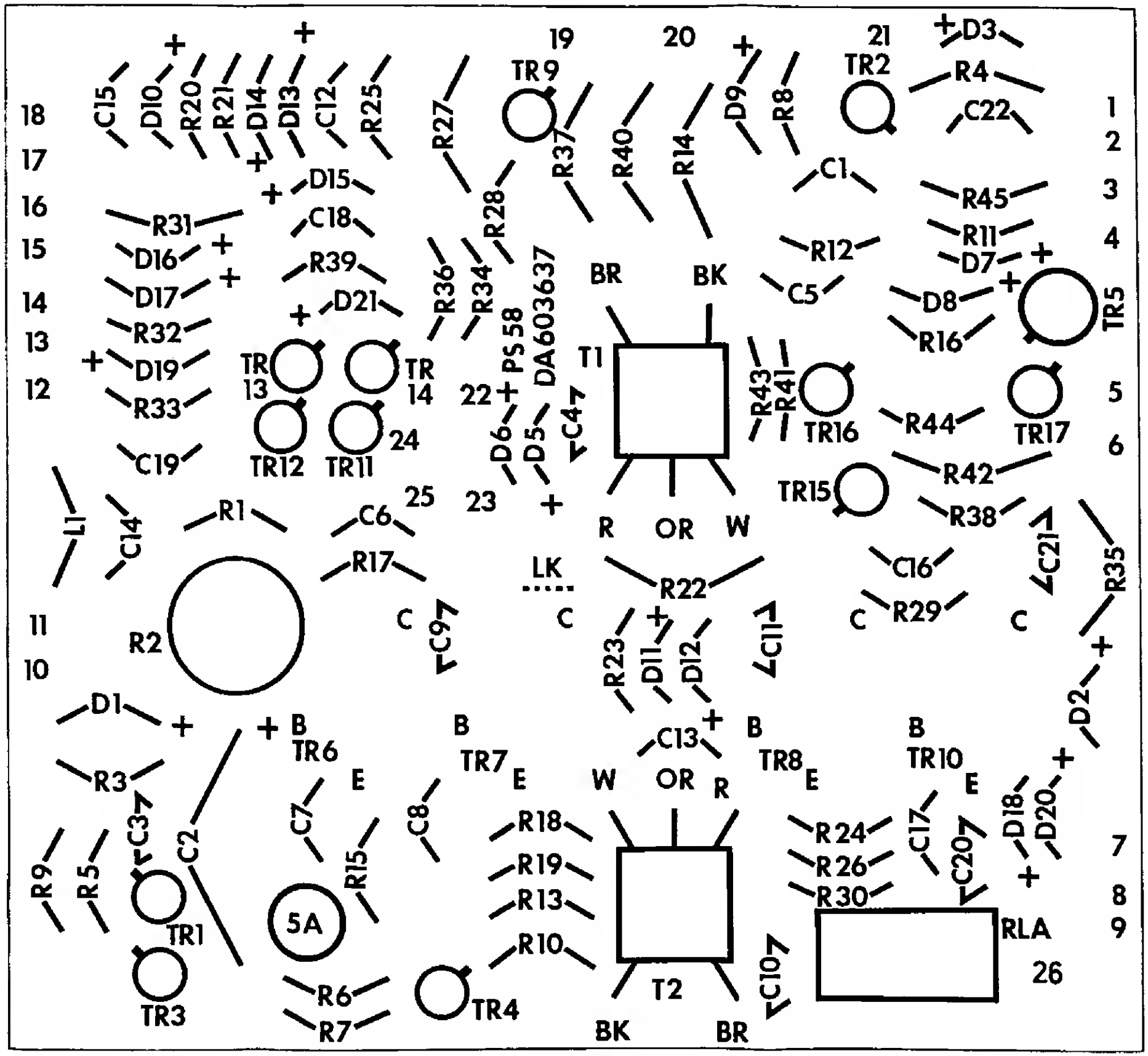


WDH 3043	CC603454
ISSUE	F 1

Circuit: Fine-Tune Discriminator (MS449 & PS56) Fig.19



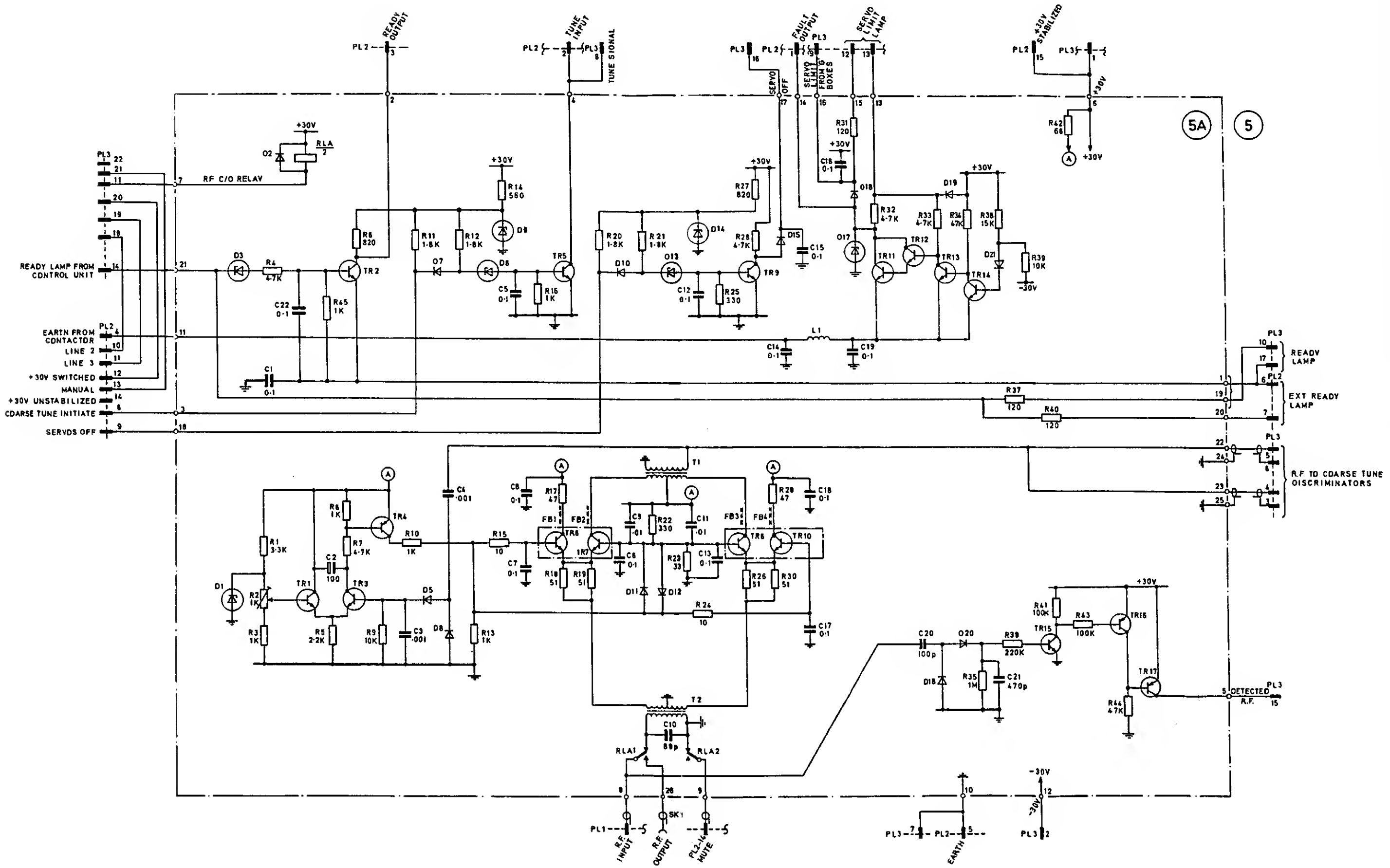
WOH 3043 Layout: Constant Voltage Amplifier (CVA) (MS454) Fig. 20



WOH 3043 | DD603636
E | 1 | 2

Layout: CVA PC Board (PS58)

Fig. 21

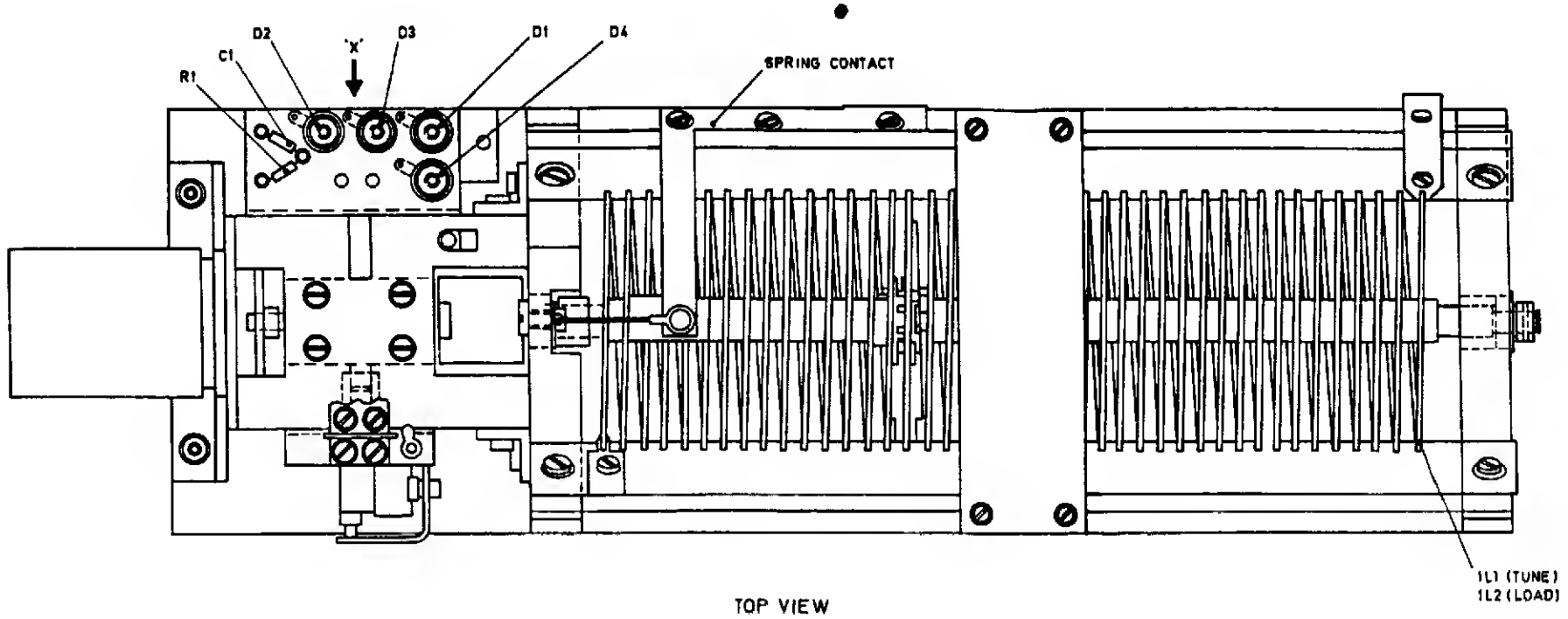


WOH3043	OC803545
ISSUE 0 1 2	

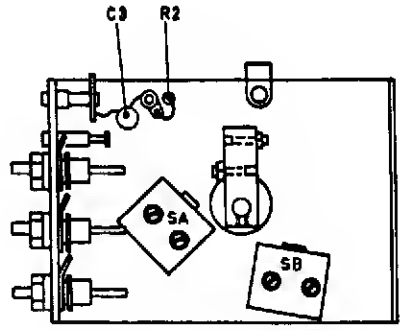
Circuit : Constant Voltage Amplifier (CVA) (MS454 & PS58)

Fig.22

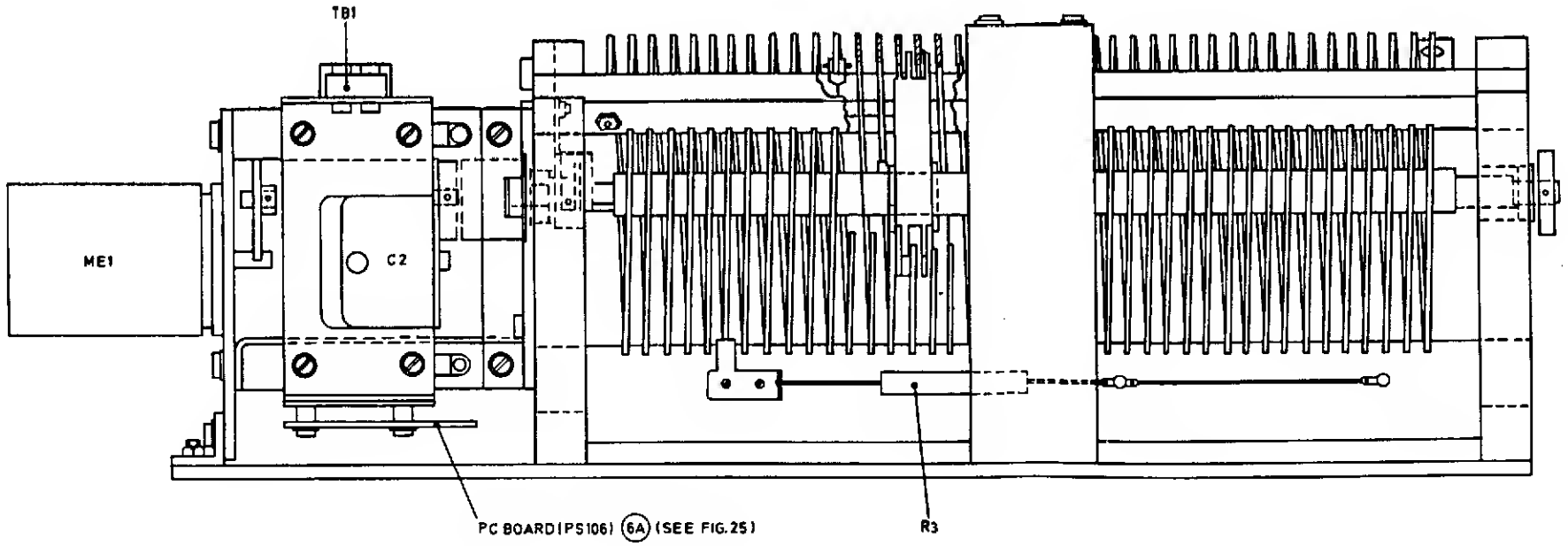
EXCEPT 1L1 & 1L2 (6)



TOP VIEW



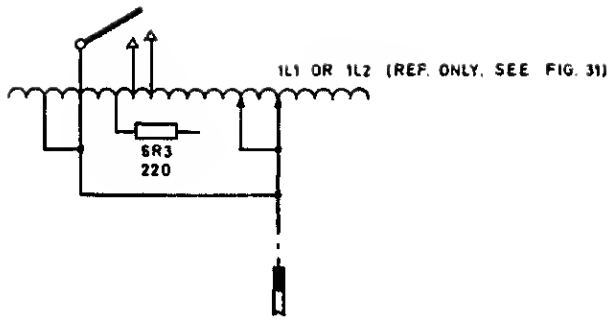
VIEW ON ARROW 'X'

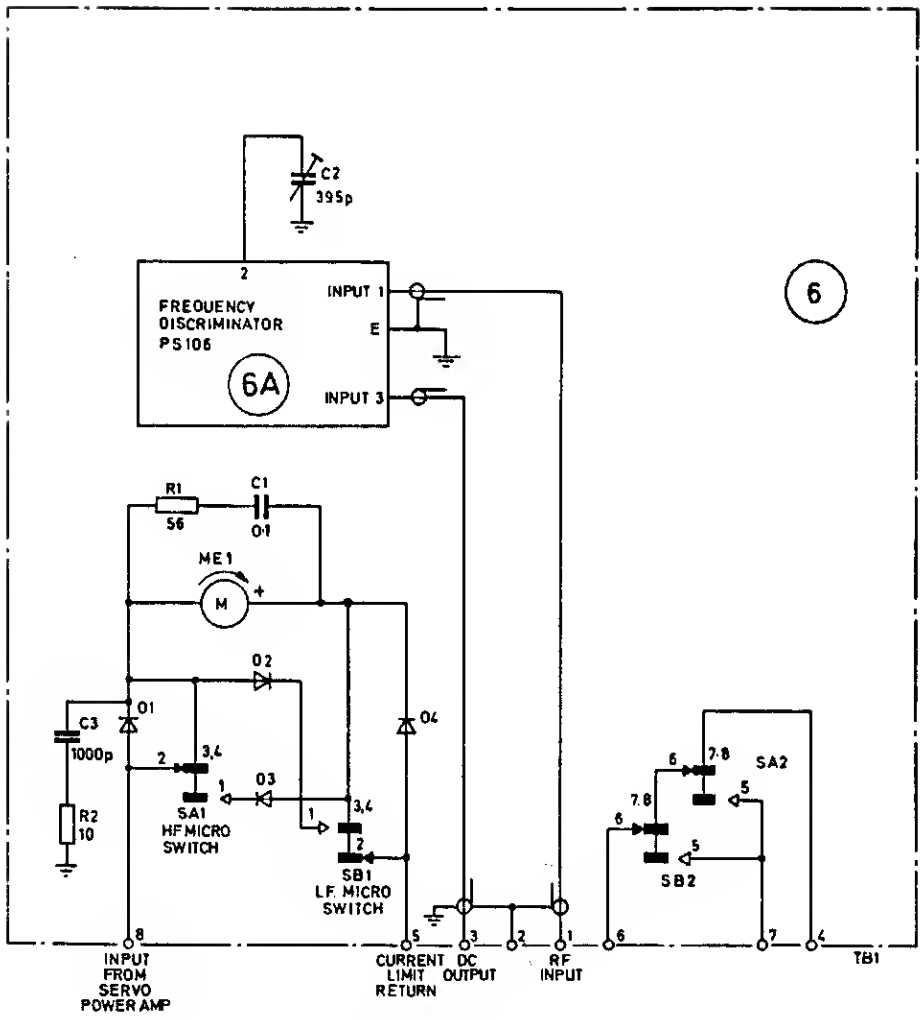


SIDE VIEW

Layout: Coil, Motor and Gearbox (MS451)

Fig.23



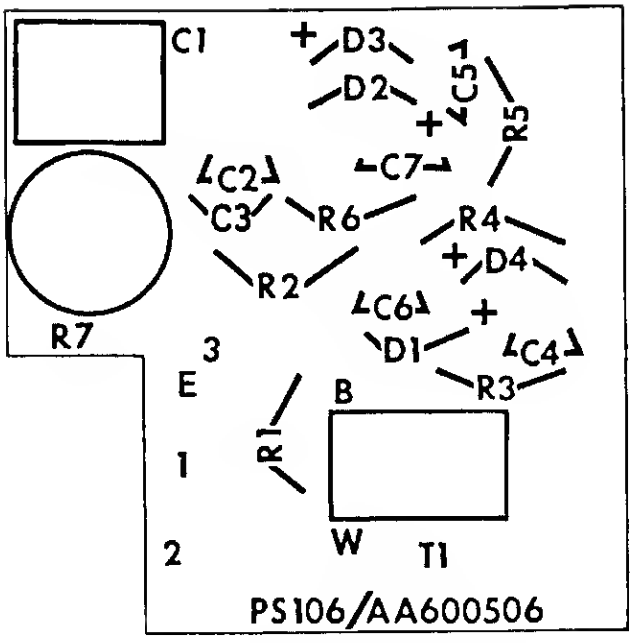


NOTE - MOTOR TERMINALS
VIEWED FROM REAR

WOH 3043	CC603155
ISSUE	01

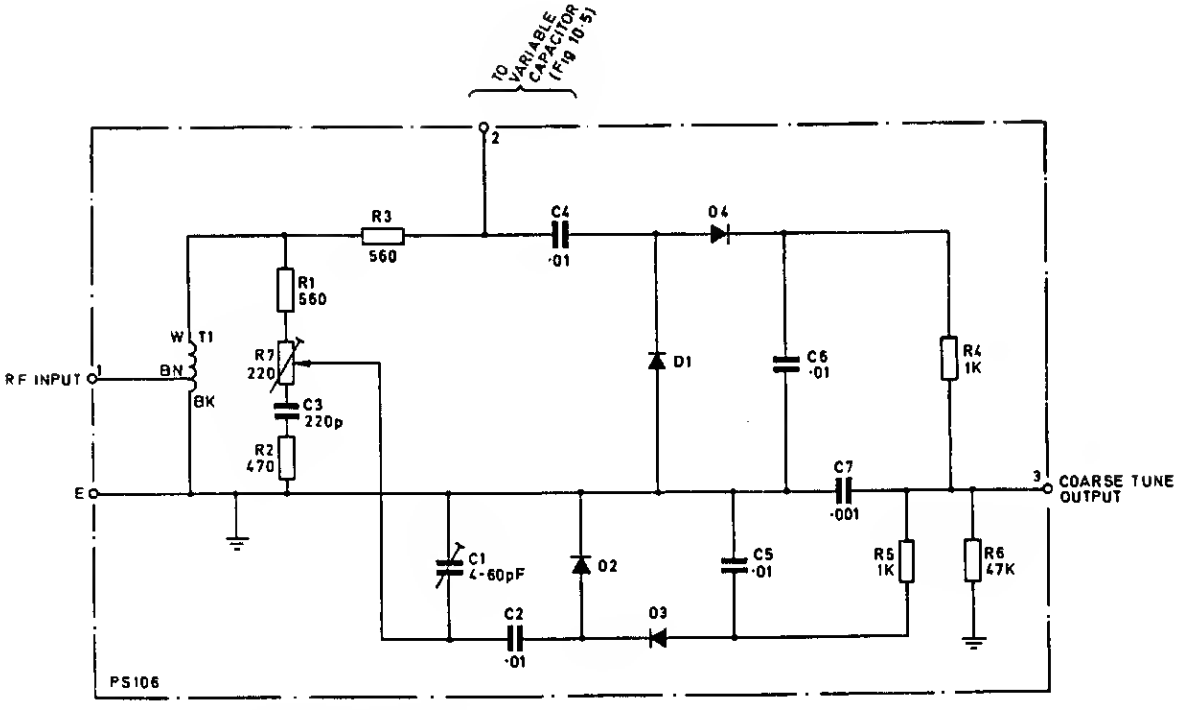
Circuit : Motor and Gearbox (MS451)

Fig.24



PC42241 SHT.3
1 2

LAYOUT



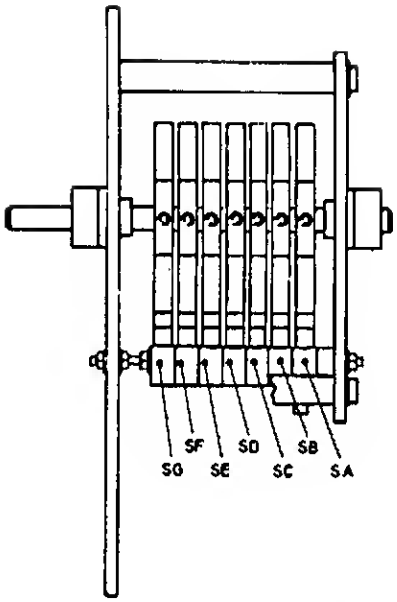
NOTE: ALL COMPONENTS ARE PREFIXED PS106

BC600506
1

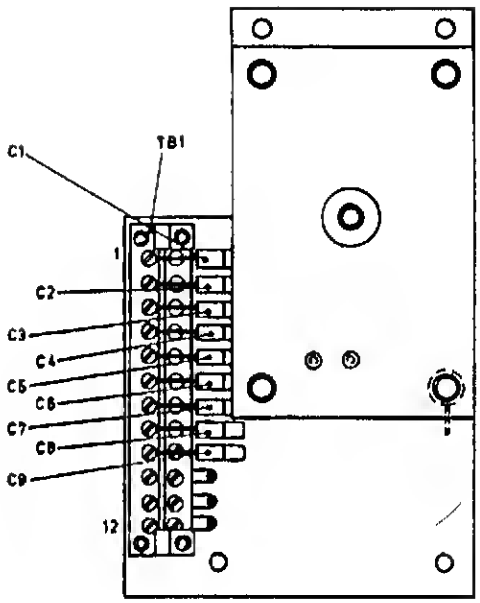
CIRCUIT

WOH 3043

Circuit and Layout: Coarse Tune Discriminator PC Board (PS106) Fig. 25



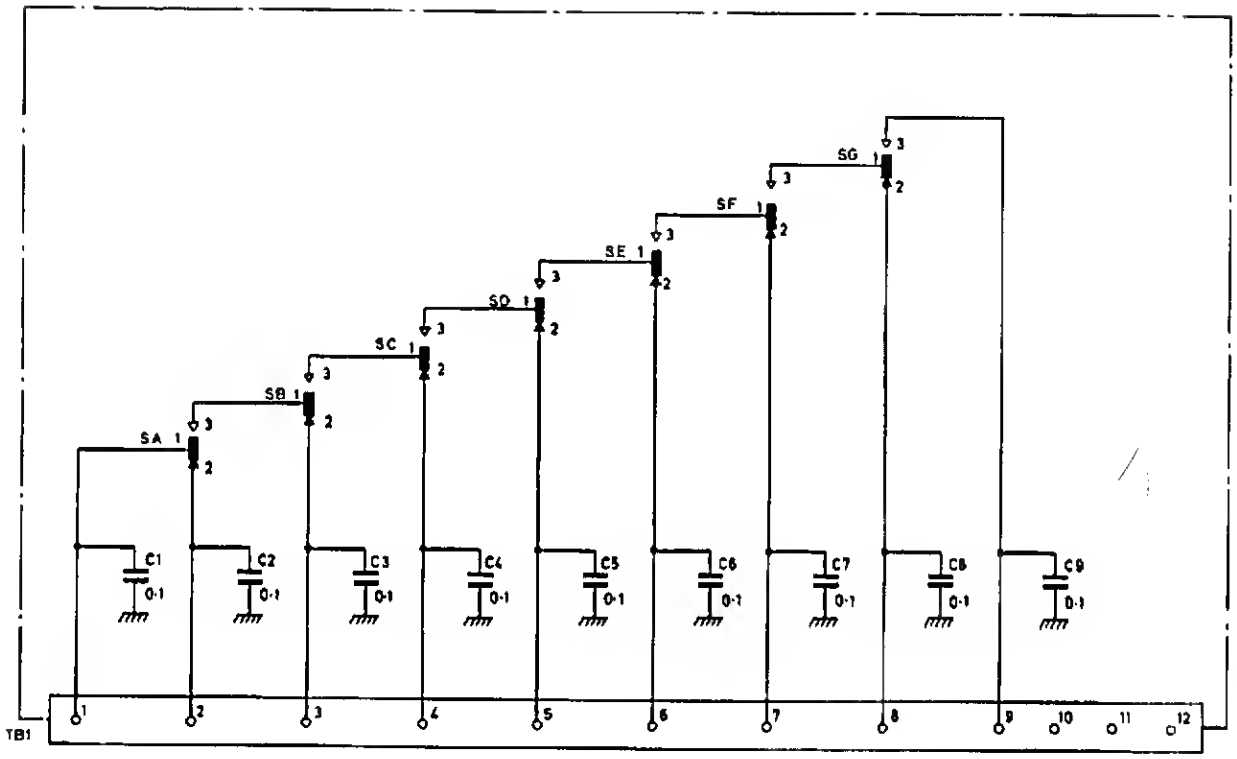
VIEW WITH TERMINAL BLOCK
AND CAPACITORS REMOVED



WDH 3043

Layout : Switchbank Assembly

Fig. 26

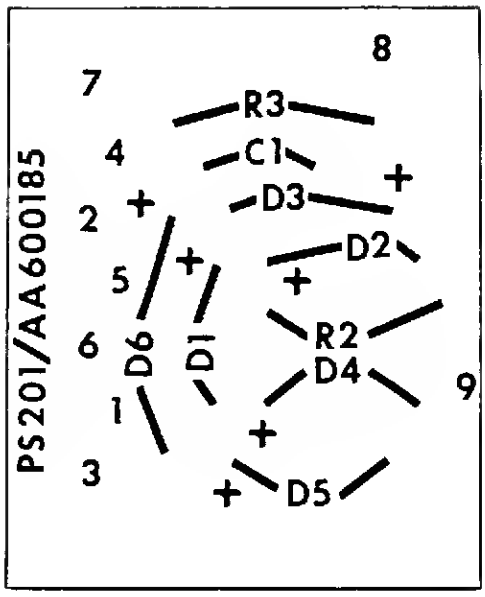


7

WOH 3043	BC803351
ISSUE	B 1

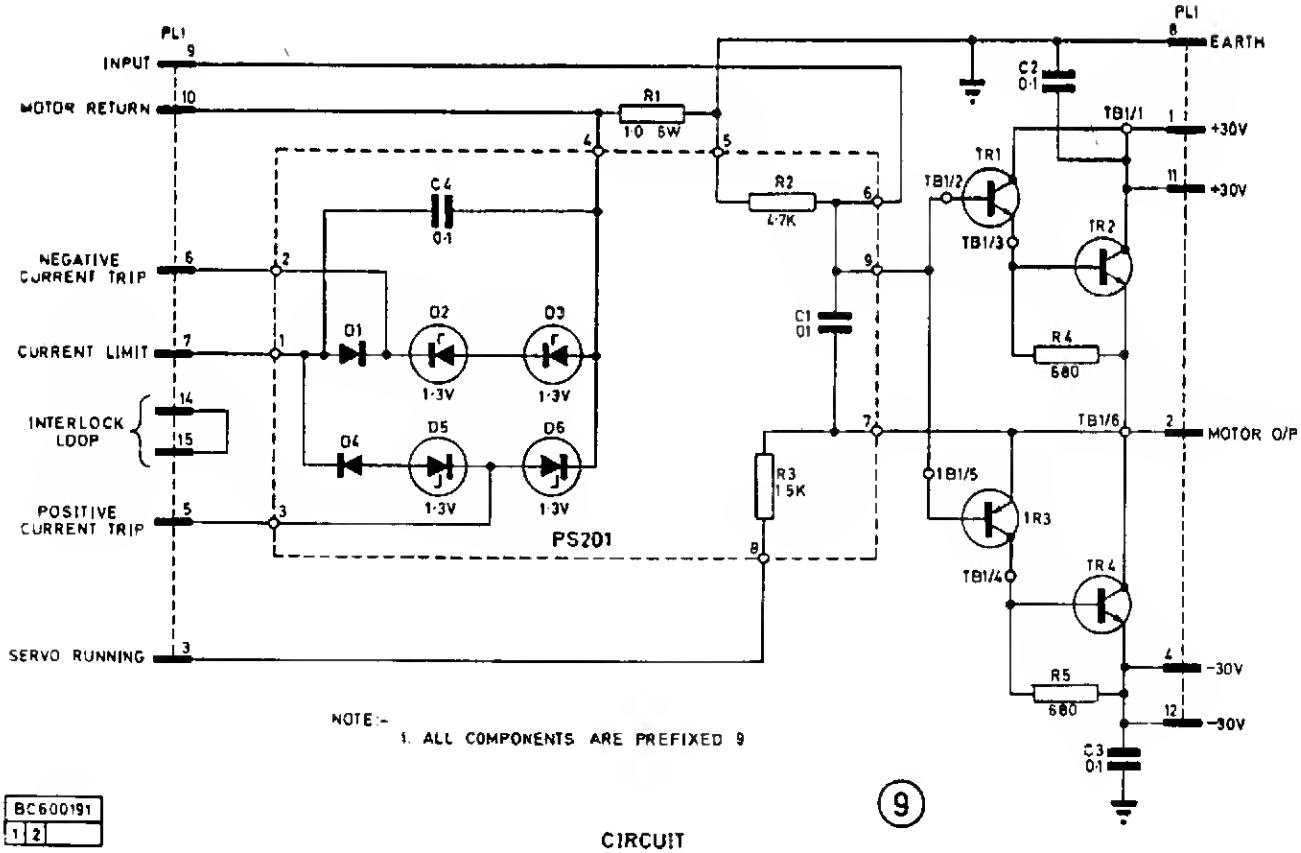
Circuit : Switchbank Assembly

Fig. 27



PC42201 SHT 2
1

LAYOUT



NOTE:-
1. ALL COMPONENTS ARE PREFIXED 9

BC600191
1 2

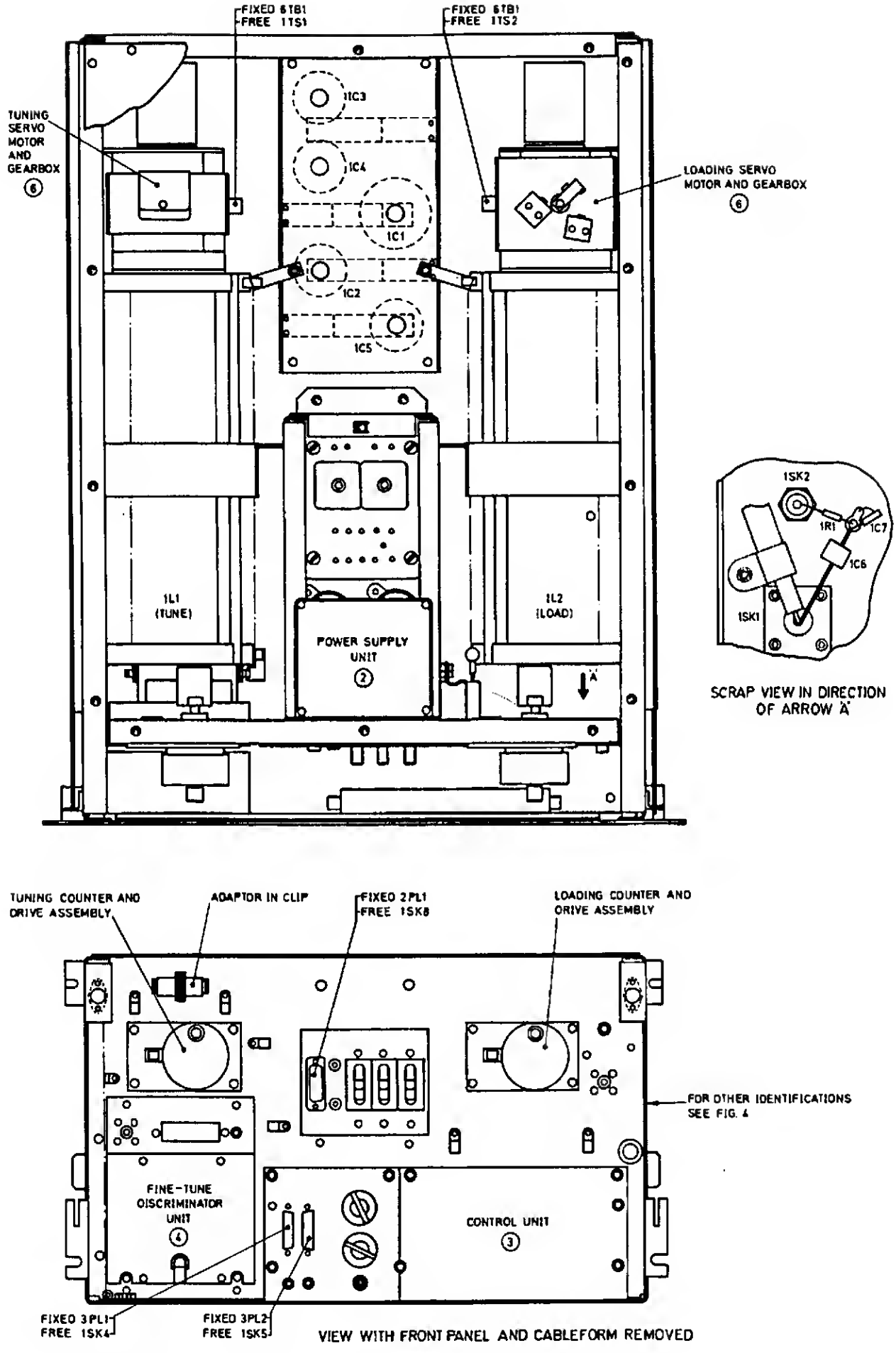
(9)

CIRCUIT

WOH 3043

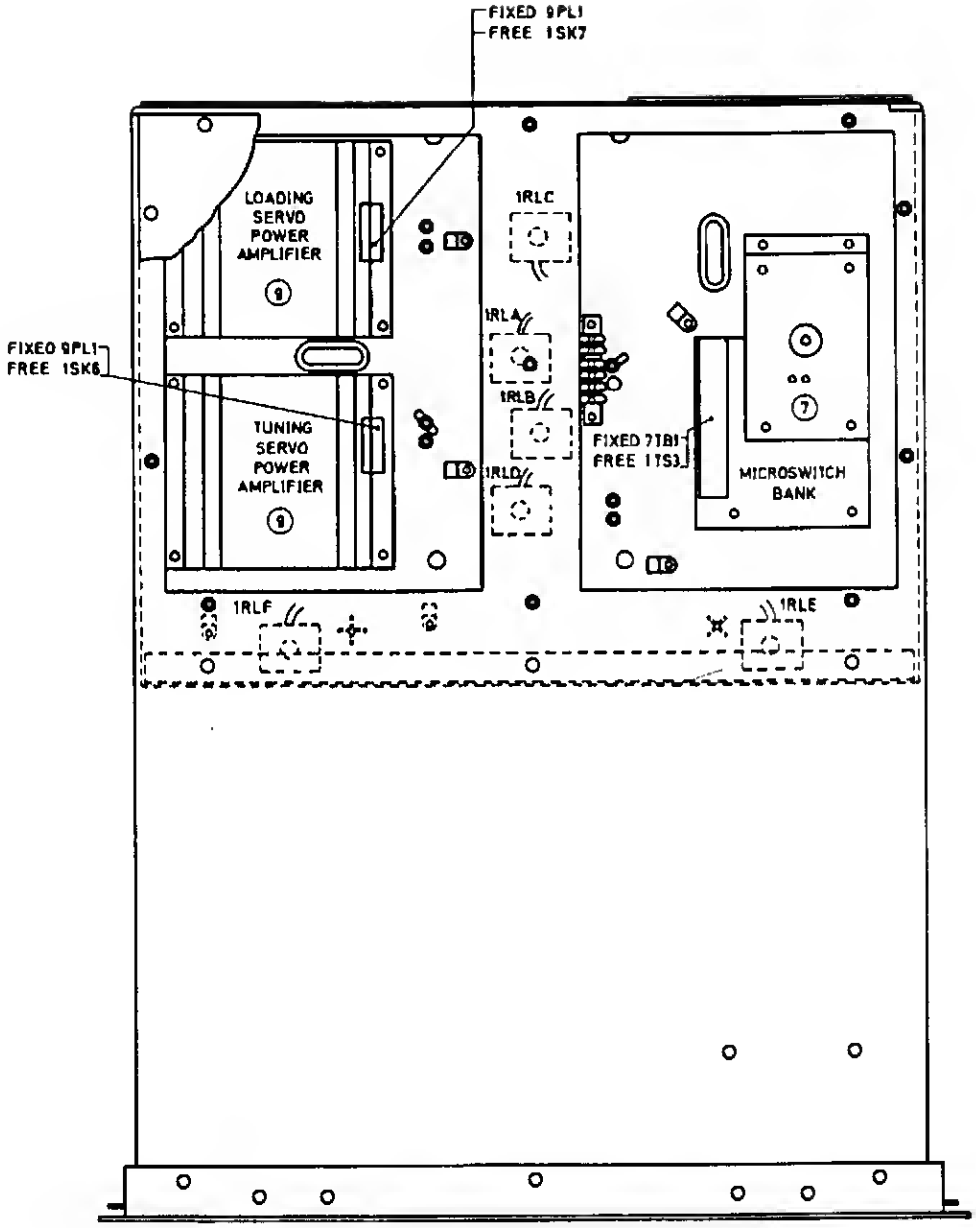
Circuit and Layout: Servo Power Amplifier (MS265 and PS201)

Fig. 28



WDH 3043

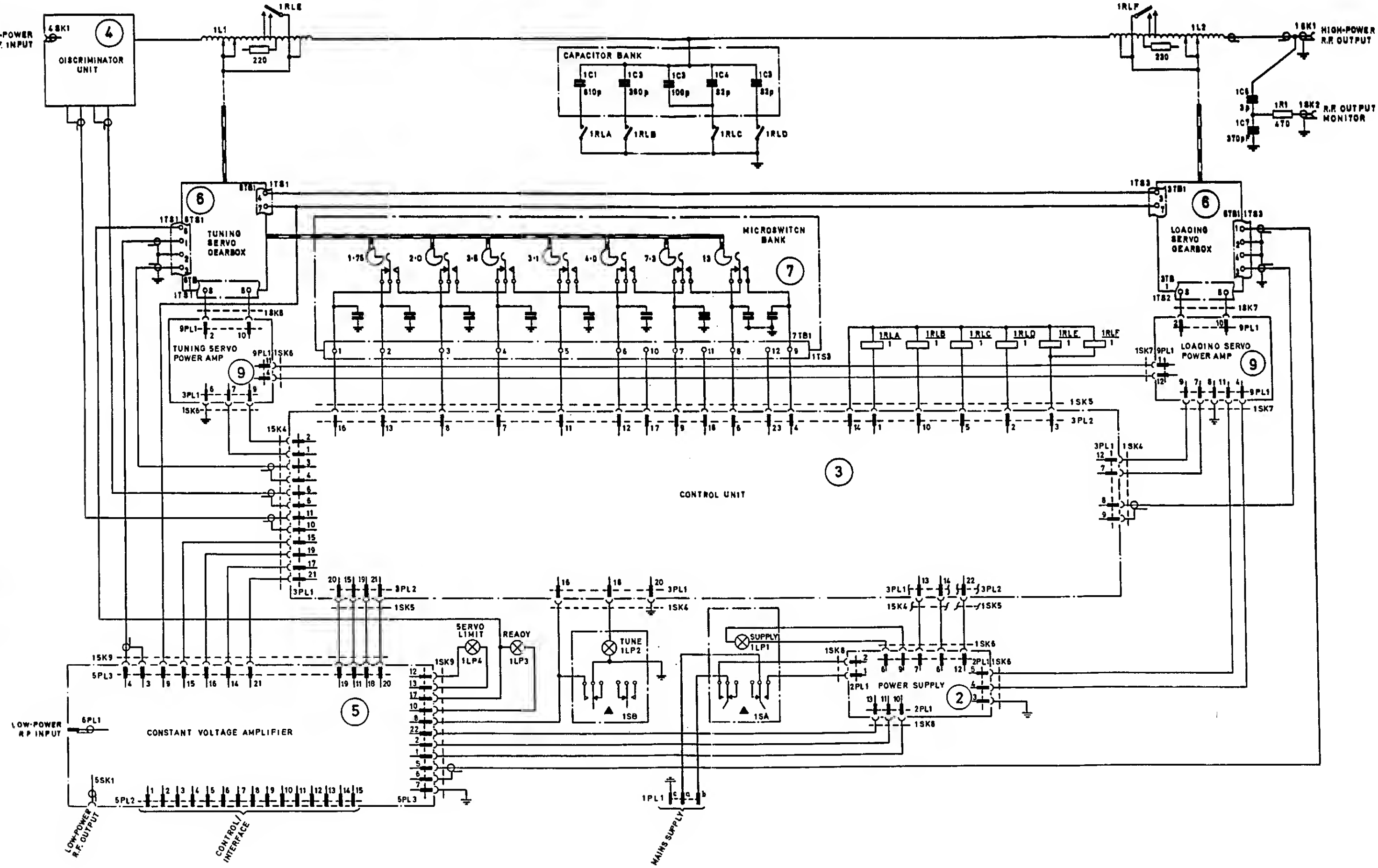
Layout : Top View and Sub-Front Panel MA.1004 Fig. 29



WOH 3043

Layout : Underside View MA.1004

Fig. 30



WOH 3043	OC603133
ISSUE A	1

Interconnection Diagram : MA1004 Feeder Matching Unit

Fig 31

RACAL COMMUNICATIONS LIMITED, BRACKNELL

AMENDMENT TO

MA.1004 FEEDER MATCHING UNIT

CHAPTER 2 Page 2-7 Para. 14.

Delete sub paras (3) to (6) inclusive.
Add sub paras (3) to (8) to read as follows:-

(3) Disconnect all the cabinet connectors from the FMU

(4) Remove the four fixings which secure the FMU to the cabinet.

(5) Lower the meter panel and slowly withdraw the FMU, taking care to support the rear of the unit as it leaves its runners.

(6) Identify the high-power cables removed (in para (3) above) from the RF INPUT and RF OUTPUT sockets on the FMU, and join them together, using the adaptor which is normally clipped to the FMU sub-front panel.

(7) Join together the two low level RF connectors removed from 5PL1 and 5SK1 on the FMU.

(8) Switch on the power supply to the cabinet

Components List

Page 8-3 Power Supply Unit.

Amend capacitor 2AC1 to read 1µF Part No. 9 .370. Manufacturer ITT, PMC2R/1.0/M100.

ILLUSTRATIONS

Fig. 7. Power Supply Unit.

Amend C1 on Board PS57 to read 1.0µF.

RACAL COMMUNICATIONS LIMITED, BRACKNELL

AMENDMENT TO

MA.1004 FEEDER MATCHING UNIT

Campanents List

Range P.C. Board (PS60) ED 603645

Page 8-8 Amend resistor 3BR11 to read 10kΩ pt No. 900986.

Page 8-9 Add capacitor 3BC26, 0.01μF fixed 20% pt No. 914967. Manufacturer ITT PMC2R/0.01/M400.

Page 8-10 Amend diode 3BD3 ta read IN5232B pt No. 924967. Manufacturer Motorola.

Page 8-25 Amend capacitor 7C1 ta read 0.01μF pt No. 914171. Manufacturer ITT PMC2R/0.01/M400.

Illustrations

Fig. 10

delete $\frac{RLA}{2}$ from TR1 emitter and earth

Insert $\frac{RLA}{2}$ between Matherbaard pins 15 and 40.

Fig. 27

Amend capacitor C1 to read 0.01μF.

Fig. 12

Amend resistor R11 ta read 10kΩ

Add capacitar 0.01μF in parallel with Diode D7.

RACAL COMMUNICATIONS LIMITED, BRACKNELL

AMENDMENT TO

MA.1004 FEEDER MATCHING UNIT

CHAPTER 2 Instollotion and Operotion

Page 2-1 Paro. 4 Supply Voltoge Tappings

Insert the following toble:-

AC Volts	Line Brown to winding 'c'	Neutrol Blue to winding 'd'	Link Resistor R1	
			winding 'c'	/ winding 'd'
210	0	105	105	0
220	5	115	115	5
230	0	115	115	0
240	5	125	125	5
250	0	125	125	0

CHAPTER 6 Mointenonce

Page 6-1 Pora. 2 and 3

Delete: paro. 2 ond 3.
Insert: new para. 2 ond 3 as follows:-

ROUTINE MAINTENANCE

2. The following procedures should be carried out at approximately 12 month intervals (more often under severe conditions of use).

Mechanicol

3. Coil ond Gearbox

(o) Examine the spur geors ond lubricate if necessory with a high temperoture lithium based grease such as 'Esso Beacon 325'.

(b) Exomine the small insulating wear strips locoted ot two corners of the rotor (either side of the coil helix) and replace if necessary using Evostik 528 adhesive.

(c) Check the backlash between the rotor ossembly ond shoft:-

Rotote the monuol tuning handle to bring one corner of the rotor ossembly to the top ond then hold the handle firmly in this position. With o suitable taol e.g. small screwdriver, try to push the corner of the rotor oround the helix in both directions. Note the two limits of FREE movement.

The distonce between these positions should not exceed $\frac{1}{8}$" ot the circumference of the coil. If this figure exceeds $\frac{1}{8}$", the bocklash odjustments shauld be performed as follows:-

Rotote the manuol tuning handle so thot the rotor contocts point to the bottom of the unit. Using a smoll screwdriver inserted between the coil turns tighten tighten both of the screws visible in the body of the rotor by $\frac{1}{8}$" turn ONLY.

Recheck the backlash as obove ond continue odjustment as necessary ensuring thot both screws ore turned through the some ongle eoch time.

Do not overtighten the odjustment screws.

CHAPTER 8 Component list

Page 8-1 Main chossis

Insert: Resistor 1R2 2.7k ohms, Metol Oxide, 5%, Part No. 906347, Electrosil TR5

Page 8-17 Add:

Copacitor 4A C12 10pF Disc Ceramic $\pm$ $\frac{1}{2}$pf 500V
Copacitor 4A C13 10pF Disc Ceromic $\pm$ $\frac{1}{2}$pf 500V

Page 8-24 Add:

Additional Resistor 6AR3, 680 ohms, Metal Oxide, 5%, Part No. 908390, Electrosil TR4 (3C 600506/C only).

Illustrotions

Fig. 18 Loyout: Fine tune Discriminator PCB (PS56)

Add: C12 in parallel with D4.
Add: C13 in parallel with D5.

Fig. 19 Circuit: Fine tune Discriminotor PCB (PS56)

Add: C12 (10p) in parallel with D4.
Add: C13 (10p) in parollel with D5.

Fig. 25 — Circuit: Coarse Tune Discriminotor PCB (PS106)

Add: an asterisk to R3.
Add: * Note: for BC600506/C, R3 to be 680ohms.

Fig. 31 — Diagram: Feeder Matching Unit

Add: Resistor 1R2 (2.7k ohms) from common connection 1RLA, 1RLB, 1RLC etc. to earth.